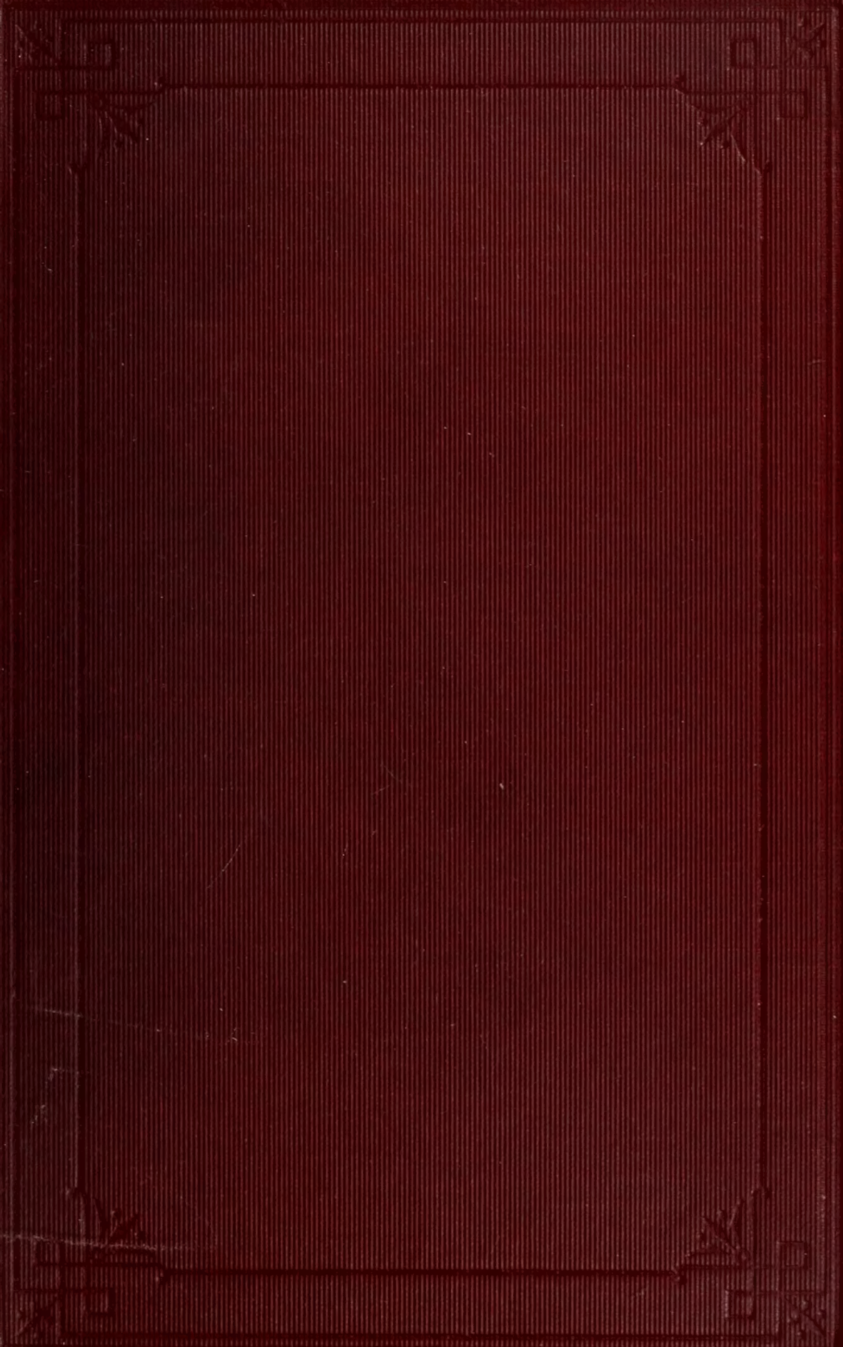

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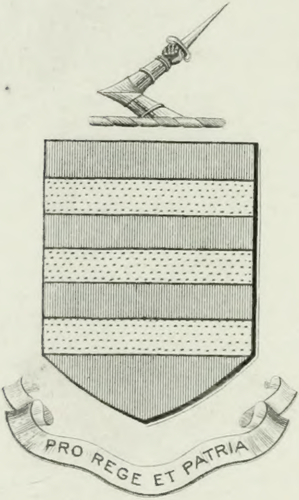

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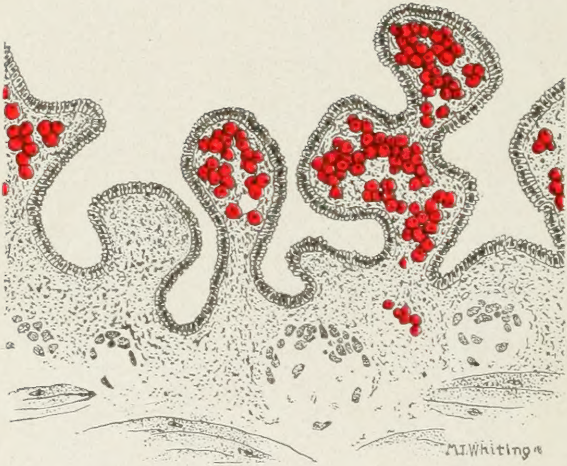
PLATE I.



Microscopic section of a "strawberry" gall-bladder showing subepithelial cells filled with a lipoid substance. Stained with Sudan 3 (MacCarty).

MPr
P

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The
Practical Medicine Series

COMPRISING EIGHT VOLUMES ON THE
YEAR'S PROGRESS IN MEDICINE AND SURGERY

Under the General Editorial Charge of
CHARLES L. MIX, A. M., M. D.
Professor of Physical Diagnosis in the Northwestern
University Medical School

Volume II

General Surgery

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INTRODUCTION.

Once more we wish to place before the surgical profession in as concise and usable a form as we can a review of what is contained in the year's surgical literature. There being less of war surgery and more of that which the active surgeon can use from day to day than was contained in the last volume.

Our foreign literature has not regained the proportion it occupied before the war.

Nothing has occurred of revolutionary importance, but much has been gained in observations and experience which will undoubtedly be of much value in the actual practice of men who are progressive in their surgical work. Local anesthesia seems to have gained considerably since the more treacherous remedies have been replaced by novocain and its various equivalents.

The importance of eliminating trauma to the greatest possible extent seems to be more fully appreciated in connection with all extensive operations than at any time in the past.

I wish to thank my friends in the surgical profession for the many words of appreciation of our previous efforts, and hope that they may find the present Year Book of value in their practice.

A. J. O.

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GENERAL SURGERY.

ANESTHESIA-ANALGESIA.

Anesthesia is one of the "phases of war surgery" spoken of by G. W. Crile.[1] After complete trial of the various anesthetics in many thousands of operations, the choice adopted unanimously by the Interallied Commission at the last conference was *nitrous-oxid-oxygen*. This anesthetic was tried in the front area, and at the base. In adopting nitrous-oxid-oxygen the allies realized that it was necessary to have anesthetists, especially trained, to give this anesthetic. It cannot be given on the basis of an M. D. degree—the degree has nothing whatever to do with qualifying one to give nitrous-oxid-oxygen. It can be successfully administered only by those who will spend an adequate time—say 3 months—in intensive training. There is no doubt at all that this anesthetic saved an enormous number of lives. The American and British armies officially recognized the nurse anesthetist. In another year, practically all anesthetists would have been nurses.

The ideal anesthetic is nitrous-oxid-oxygen, plus local anesthesia. Of course, in Crile's clinic this has been used for years. It was tried out extensively, especially in abdominal surgery, by the British. They tried out the double anesthesia method on a large scale, and found it cut down the mortality rate 50 per cent. Some of the French and Italian surgeons demonstrated without any question the correctness of a conclusion which was first arrived at and acted upon at his clinic, viz.: That if novocain anesthesia is used, there is no shock at all. The low spinal anesthesia was considerably used in thigh amputations. Spinal anesthesia cut down the mor-

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(1) Railway Surg. Jour., November, 1919.

tality rate 3:1. It was found that nitrous-oxid and oxygen without blocking would do the same thing—cut down the mortality rate 3:1. Then Capt. Taylor, a British surgeon of larger experience, used the method of local plus nitrous-oxid-oxygen anesthesia.

The effect of *anesthetics in the tropics* is commented on by L. M. Routh [2] following a 3½ years' stay in India. It has been claimed that ether, at least by an open method, cannot be employed, this he found entirely erroneous. In Bombay, though a moist climate, ether can be administered, either pure by the open method, or with chloroform; if pure ether is used very little more ether is needed. "Up country," with a dry climate and a temperature well over 100° F., open ether can be given satisfactorily, but is necessarily more extravagant owing to the atmosphere. In Bombay, for routine administration ether 3 parts and chloroform 1 part is very convenient, and patients remain comfortably "under" the same as with the C.E. mixture—(chloroform 2, ether 3). A further dilution still with ether is frequently advantageous, and in serious cases pure open ether.

[In our hottest summer days the temperature so nearly equals the temperature under which operations are performed in India, that we are quite as able to judge of the effectiveness of ether anesthesia in high temperatures. Surgeons who have habitually operated with chloroform-anesthesia are very likely to find some reason against changing to ether, which is probably the reason why ether has been so slow in being accepted in the tropics.

The most important reason, however, lies in the fact that in India ether is so expensive that it is rarely obtainable; because the boats which carry this highly-explosive substance are not permitted to carry it in the body of the ship, but must carry it as deck-freight, thus taking the risk of having it washed overboard during the violent tropical storms. As most teachers in medical schools are not familiar with conditions in the tropics, they have usually mistaught their students regarding the use of ether in the hot countries.—Ed.]

Chloroform, relatively dangerous, especially for those

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(2) British Med. Jour., Oct. 11, 1919.

debilitated after field service. Its use in the pure state should be almost entirely confined to operations requiring Junker's inhaler. It is necessary in such a climate to keep stock bottles in a cool and dark place.

Although patients "go under" as easily and quickly as in England, there is increased danger during the induction stage, especially with any struggling.

Ether. A *modification of the open method* is suggested by the well-known London anesthetist, J. F. W. Silk.[3] The preference for this is perhaps largely, he believes, because on paper—at any rate—it seems to be so simple and so devoid of difficulty and danger. However, omitting the question of safety, it will be found (especially by the beginner, of if ether alone be used from start to finish) the method is not so simple as appears. As consulting anesthetist he paid nearly 1000 visits to war hospitals, and believes the chief difficulties in the attempt to use ether from the beginning are: 1. Induction is much prolonged, frequently as much as 20 min. 2. Nearly all object to taste and smell of "straight" ether, and this is often the prelude of respiratory spasm, and struggling. 3. In over-robust or alcoholic subjects, complete relaxation is difficult or impossible. 4. Amount used often excessive, 12 to 16 oz. per hour is not uncommon.

McCardie (1918 volume, p. 11) advocated the use, in a Clover's inhaler, of 1 part of chloroform to 16 of ether, but Silk finally settled upon the following:

Chloroform	1 dram
Ether	32 drams (4 oz.)

This is approximately 3% of chloroform in ether, or a very little stronger (3 in 99).

In using this mixture the following are the chief points to be attended to. Although not essential, it is of advantage the patient should have a preliminary injection of morphin ($\frac{1}{6}$ to $\frac{1}{4}$ grain) and atropin ($\frac{1}{100}$ to $\frac{1}{60}$ grain). The face-pad and mask is the same as for open ether, the mask being closely applied to the face and face-pad from the very beginning. The liquid is used exactly as if it consisted of ether alone, the chloroform

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(3) British Med. Jour., 1919, 1. 635.

being ignored. During induction the liquid is poured freely on to the mask just to the verge of resentment, but when consciousness and reflexes are abolished, it will suffice to reduce the supply to the dropping stage. If at any time during the operation it be thought that anesthesia is not sufficiently deep, there need be no hesitation about increasing the amount. The same care in watching and maintaining the breathing are required as in any other method; the plan makes no pretense to be "absolutely fool-proof."

In his own hands and many others, the combination has given excellent results. It is really quite remarkable how such a small quantity of chloroform should go so far in converting the pungent ether into a comparatively bland vapor. The patient has much less objection to the inhalation than when pure ether is used; there is also less respiratory spasm, less lividity, and the struggling is practically limited to the simple movements of the stage of excitement.

The flow of mucus and saliva may be excessive, and when this is the case the patient is very apt to develop an undue amount of postoperative bronchial irritation. Continuous practice will, of course, go a long way towards mitigating these troubles. The prior injection of morphin and atropin, especially the latter in tolerably large doses, is also a great help, particularly with regard to the excessive salivation and tendency to bronchial irritation. Usually, however, the anesthetist seeks to overcome the difficulties by starting with a little chloroform or "mixture." This is generally administered upon the same mask as prepared for the ether alone—*i. e.*, 12 to 16 layers of gauze with an underlying face-pad, patient carried to complete anesthesia, and the pure ether is substituted as soon as it is thought he will no longer resent the change. In perhaps the majority of instances this plan succeeds well enough for all practical purposes, but in rather a large number a tendency to respiratory and cardiac failure develops in 2 or 3 min. after the change to pure ether has been made. Silk believes in some cases deaths have resulted.

[The objection to this plan is that in the hands of an anesthetist, who is not an expert with good judgment, the patient is exposed to the use of an exceedingly dangerous anesthetic, for one which is virtually entirely safe in the hands of any anesthetist with ordinary intelligence.—ED.]

Gwathmey's plan of *general analgesia by oral administration* was referred to in the 1919 volume (p. 29). G. H. Burnell [4] gives his experience in 70 cases, compared with 24 by open ether alone. He began with the original method giving 15 min. before operation:

Ether	½ oz.
Chloroform	½ dram
Liquid paraffin or olive oil	to 1 oz.

the above being "sandwiched" between two mouthfuls of port wine. It was found, however, the patient often vomited the mixture, so the next step was to give chloretone, grs. x., 1½ hours before taking the mixture. This has almost completely abolished the vomiting.

It was also found 15 min. was not a sufficient interval, 30 to 40 min. were needed. Most patients came in drowsy, a few hysterical, 5 were asleep. For major operations the "gastric ether" has always to be reinforced, even patients who are asleep will tolerate only the slightest manipulations. In some cases ⅙ gr. of morphin was also given, but seemed to make no difference.

They increased the dose of "gastric ether" to 1½ ozs. of the mixture, and in some robust men have given 2 ozs.; 1½ ozs., however, is the routine dose. It is noticed the abdominal muscles are beautifully relaxed, and this, to one who has tried operating through a rigid wall, will be welcomed as one of the chief advantages of the method. It was hoped this method would save considerable ether, but it has not proved to be so great as was expected. (At the market price it was a trifle over 40 cents per hour).

After operation, the patient usually sleeps 4 or 5 hours. He can usually be roused within an hour, but after that remains in a slight sleep. The nurses are unanimous in stating that patients anesthetized by the combined method seem to escape much of the usual post-

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4) Med. Jour. Australia, Nov. 16, 1918.

operative pain by their long sleep. Postoperating vomiting is neither more nor less than in ordinary cases.

The disadvantages are: Slightly more pre-operative preparation, viz., giving the chloretone and "gastric ether." This is very little extra, as no special preparation is necessary. In 2 cases the respirations have reached a very low rate after return.

Silk[5] points out that many of the troubles during an anesthetic have their origin in some *obstruction to the respiration*. For some years a plan adopted by him has been successful in many cases. It simply consists in making use of the nose for passage of a tube into the naso-pharynx well behind the tongue. The value of this proceeding is partly due to the fact most patients, especially under an anesthetic, breathe, or endeavor to breathe, through the nose, and partly, to pushing forward the soft palate and preventing the complete falling back of the tongue. The tube is an ordinary straight rubber drainage-tube of fairly firm texture and 6 or 7 in. in length. It is better too long than too short. As the depth of the naso-pharynx varies it is only necessary to pass the tube far enough to ensure a very appreciable current of air can be felt by the hand held over the tube projecting from nostril. The exact depth being thus determined, a safety-pin may be passed through one wall to prevent tube slipping back. The tube should be as large as possible. For the average male adult this will be about $^7/_{16}$ in. in diameter, for females about $^5/_{16}$ in., and rather less for children. One end is bevelled off at about 45°, and a hole may be cut about 1 in. above and at right angles to the bevel (figure). The bevel en-

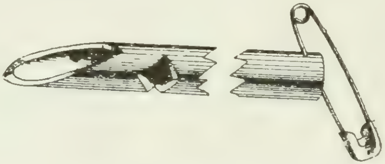

Fig. 1. Tube to overcome obstruction of respiration (Silk).

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(5) Lancet, June 14, 1919.

ables the tube to pass by any slight obstruction and the second hole affords additional security. The cut edges smoothed by a file or sandpaper.

Of almost more importance than the actual size of the tube is the method of passing it. After patient has been anesthetised the bevelled end is oiled or vaselined, then inserted into the nostril of either side, almost at right angles to the face, and worked gently back; no force need be employed, and particularly, no upward direction should be given to the tube. If any slight obstruction be met with, this will often be overcome by twisting the tube round and so enabling the bevelled end to open out its own passage. If it should not do so, the other nostril should be tried. Occasionally, and especially on the first few attempts, a little bleeding may follow the passage, but this soon stops. As one becomes more experienced, even this slight trouble becomes less frequent. If the finger be passed after the tube has been inserted, it will be found it is well behind the base of the tongue, which, in fact, often rests against it, and the openings of the tube are about on a level with or just above the glottis. Whatever troubles may now arise—*e. g.*, spasm of the glottis—free air is ensured.

This tube is neither necessary nor desirable in every case. Silk only uses it when he should otherwise be obliged to hold forward the jaw from the angles (a tedious proceeding and a painful one), as in commencing lividity or undue stertor. Neither ought this plan entirely to supersede the mouth prop or Hewitt's tube, or other methods of securing an open air-way.

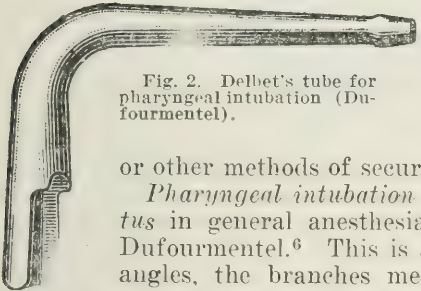

Fig. 2. Delbet's tube for pharyngeal intubation (Dufourmentel).

Pharyngeal intubation by Delbet's apparatus in general anesthesia is described by L. Dufourmentel.[6] This is a tube bent at right angles, the branches measuring respectively 4.4 and 3.2 in. The longer has a collar connecting it with the ether chamber; the other becomes

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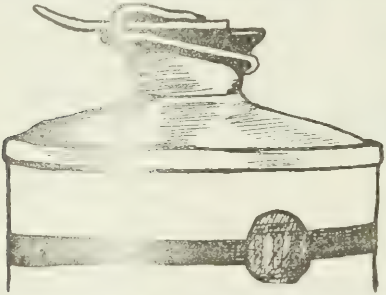
(6) Presse Méd., Sept. 22, 1919.

flattened and ends with a long notch which is to close the aperture of the larynx into the pharynx.

In use the patient is anesthetized with a compress or mask. As soon as anesthesia is sufficient, the tube is inserted deeply enough for the posterior branch to reach the larynx, the other then comes out between the lips, the larynx being well stopped, the current of air is felt coming out of the pipe. Then the tube from the ether chamber is connected, and if necessary tampon the pharynx about the tube to prevent any blood being swallowed. This carries out the best possible conditions for cervicofacial anesthesia—anesthetist some ways off, no blood can enter air or food passages, suppression of the usual vomiting. It is much simpler, quicker and less dangerous than the trachea tubes which can only be inserted under control of vision.



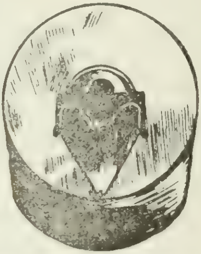


Fig. 3. Top of ether can with dropper.
Fig. 4. Dropper in position on can—schematic (Hill).

The *ether-dropper* evolved by I. E. Hill[7] is made of thin sheet metal and triangular, with the base covering half the mouth of the can. To the back of the metal is a wire spring loop which allows it to be instantly applied or removed. Whether the entire metal cap is cut out or two holes simply punched in it, the dropper will serve with equal satisfaction.

The main points of a *nitrous oxid-oxygen-ether outfit* described by H. E. G. Boyle[8] are: (1) Each cylinder

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(7) Jour. Amer. Med. Ass'n, Dec. 27, 1919.
(8) Lancet, Feb. 8, 1919.

is provided with a fine adjustment reducing valve; (2) the "sight feed" has been adopted; (3) a small spirit lamp for warming the valve to the nitrous oxide cylinder; (4) a pressure gauge to the oxygen cylinder; (5) a small rebreathing bag is attached, with an ordinary 3-way stopcock and face-piece; (6) an ether bottle is connected up; (7) made in 3 sizes:—(a) The large for work abroad. This, when fully charged, takes 4 cylinders of 200 gallons, 2 of 500 gallons, and 1 of 40 ft. capacity for oxygen. (b) The one depicted—is for hospitals at home, and carries 4 cylinders of oxid of 200 gallons each, and

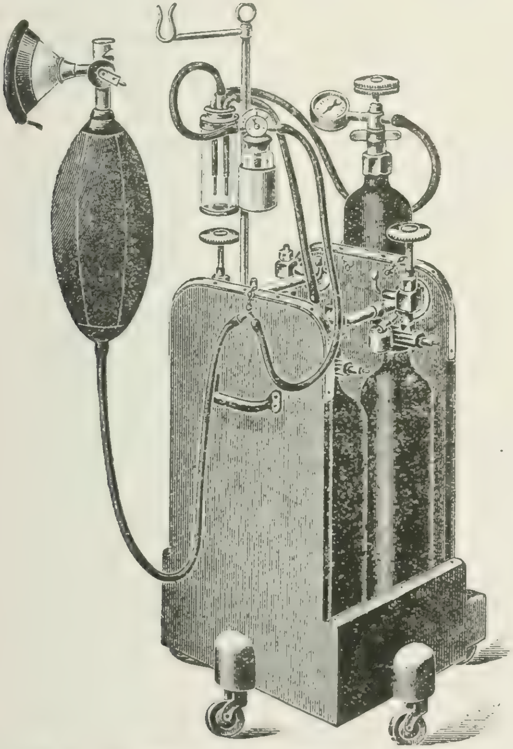

Fig. 5. Nitrous oxid-oxygen ether outfit (Boyle).

a 20 ft. of oxygen. Types (a) and (b) are on wheels. (c) For private practice takes 4 cylinders of 100 gallons, 2 of oxid, and 2 of oxygen. Cylinders of 25 or 50 gallons can be used with this pattern. This type is so devised the stand carrying the "sight feed" and ether bottle can easily be dismounted and stowed away between the cylinders. There is a covering lid and carrying handle. These machines are economical in gas. 80 gallons of oxid and 20 of oxygen are usually enough for one hour's continuous anesthesia. Some 3,600 administrations have been successfully given.

Rectal Anesthesia. Some observations made on *100 anesthesias by this route* are given by T. C. Clayton.[9] The patients were all soldiers, no women or children, and all operations were done for facial work. Owing to various war conditions the most perfect procedure has been impossible. These difficulties arose owing to (1) the shortness of preparation, sometimes not even 12 hours; (2) difficulty of obtaining the necessary tranquility after the preliminary morphia and atropin; (3) inferior ether; (4) necessary substitution of peanut for olive oil; and (5) inferior atropin.

Theoretically, the dose should be in ratio with the body weight; practically this does not appear to be so any more in this method than in any other. The personal equation and fitness seem to play a much more important part. Out of the 100 cases he had an overdose in No. 95—and practically all the others have been on the light side, with doses increased from 5 oz. to 6 oz. quite irrespective of the weight. Advantages.—(1) A more pleasant induction; (2) less vomiting; (3) more even anesthesia; (4) less anxiety and exertion for the anesthetist; (5) elimination of bronchial irritation. Disadvantages.—(1) A lengthened preparation owing to the extra bowel irrigation; (2) more trouble for the nurse by the after wash-out; (3) earlier hours for the anesthetist; (4) occasional anal tenderness; (5) on the whole, a lengthened recovery.

	(A)	(B)	(C)	(D)
Number of cases	26	41	19	14
Average length of operation (hours)	2	2	2	2½

---

[9] Lancet, May 10, 1919.

	(A)	(B)	(C)	(D)
Auxiliary induction	17	30	15	9
Frequent auxiliary anesthetic	5	10	10	4
Occasional auxiliary anesthetic	13	15	5	3
No auxiliary anesthetic	8	16	3	8
Returning the injection	0	1	1	0

(A) Morph. c. atropin. c. hyoscin. Olive oil c. ether 5 oz. c. paraldehyd.

(B) Morph. c. atropin. Peanut oil c. ether 5 oz. c. paraldehyd.

(C) Morph. c. atropin. Peanut oil c. ether 5-6 oz.

(D) Morph. c. atropin. Olive oil c. ether 5-6 oz. c. chloretone 25 gr.

Chalier and Dunet[2] report on *72 cases.* They prefer fractional doses. The method is formally contraindicated in all interventions on the abdomen because of the intestinal distension it sets up; also where intestinal lesions or hepatic alterations are present. However, it is especially useful in the surgery of the skull, face, mouth and throat, neck and chest.

Local Anesthesia. A. L. Soresi[3] remarks that *incisions can be made painlessly* by dipping the scalpel in pure carbolic acid. They will not be followed by even the smarting which follows by other methods. A dry, sterile scalpel is dipped in pure phenol. The point of the back is passed over the incision, to mark it with the phenol. A few seconds later the scalpel is dipped again and the tissues incised very gently, the scalpel being moved up and down as with a saw. A film of the phenol is deposited on the blade; this film comes in contact with the tissues as they are cut, thus anesthetizing them. This film is rubbed off by the tissues or washed off by the blood, and has to be renewed by dipping as often as is necessary, according to the depth to be incised.

The phenolated scalpel, for obvious reasons, should not be used when reunion by first intention and suture are desired. The scars produced are never ugly; in fact, they are much better than those resulting where drainage was necessary. A slight redness lasts at times for some days, but disappears completely in a short time. The method has been used in over 3,000 cases, without the slightest indication of absorption or poisoning. Even

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(2) Presse Méd., Oct. 11, 1919.

(3) Jour. Amer. Med. Ass'n, May 3, 1919.

very deep tissues may be incised, over 100 pleurotomies, 4 into Douglas' pouch, etc.

Adrenalin as an adjunct to and antidote for apothesine is considered by H. C. Hamilton.[5] Apothesine is a local anesthetic which is materially less toxic than cocain and is entirely free from habit-forming effects. By laboratory tests on the sciatic of the frog and intracutaneously applied to human subjects—it is demonstrated to be equal to cocain; in its action on mucosa, while less effective than cocain, it is identical in degree and kind with novocain.

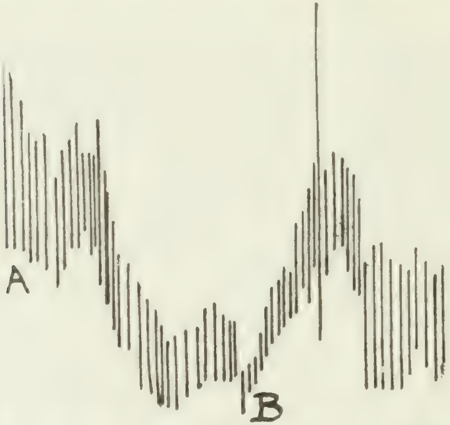

Fig. 6. *A*, Injection of 0.32 gms. apothesine and 0.00001 gms. adrenalin. *B*, Injection of 0.00001 gms. adrenalin (Hamilton).

The minimum fatal subcutaneous dose of apothesine, based on guinea pig experimentation, is several times that for cocain, *i. e.*, it is much less toxic. The fatal dose calculated to the average weight of a man is more than ½ oz. of the pure crystals. The toxic effects are exerted largely on the circulatory system.

What is therefore more natural than to turn to adrenalin, the characteristic effects of which on the circulatory system are exactly the opposite of those of apothesine and which when properly administered acts even

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(5) Surg., Gynecol. and Obstet., July, 1919.

more quickly. Experiments on dogs confirmed this theoretical effect and proved that an otherwise fatal dose could be favorably influenced by administering adrenalin chlorid solution, and that when the latter was injected with the apothesine intravenously, its depressing action on the heart could be eliminated entirely. Although in rare cases only is apothesine injected intravenously, its effect is much more rapid and identical in kind with that from subcutaneous injection, and produced by a much smaller dose. The results, therefore, are comparable although the doses are not.

The simultaneous administration of adrenalin with apothesine, as with cocain and novocain, is only to localize and intensify the anesthetic action, since its stimulating action on the heart and vessels is obtained only by intravenous injection. But the antidotal effect is indirectly effective even from the subcutaneous administration because adrenalin prevents general absorption of the anesthetic and by intensifying the action of the apothesine makes large doses unnecessary. The value of adrenalin, therefore, for both purposes, to limit absorption and to sustain the heart, is due to its characteristic properties of constricting the blood-vessels and acting as a prompt and powerful cardiac tonic.

A *pneumatic injector for local anesthesia* is introduced by E. G. Slesinger,[6] designed to overcome some of the difficulties and objections to the usual syringe method, particularly in extensive operations or when local anesthesia is desired as an adjunct to gas and oxygen in abdominal work: It consists of a glass container in a metal frame with a graduated scale. This frame has a top and bottom cap, each of which screws into position, and, being lined with composition material, forms with the glass cylinder an airtight chamber. In the top cap of the container is a tube fitted with a tap, in the end of which is an ordinary Dunlop bicycle valve, and a funnel with a screw plug for filling. The bottom cap has an exit tube with a tap. From the exit tube, by means of a connection with a bayonet catch, runs a flexible metal tube to the other end of which the injection valve is attached by another bayonet catch. The valve

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(6) British Med. Jour., Aug. 2, 1919.

is so constructed when at rest no fluid can flow through it, but on light pressure on the button a free flow is established. To the distal end of the valve any desired type of needle can be fixed by a bayonet catch. The whole apparatus can be readily boiled before use.

The fluid for injection is poured in through the funnel and the plug screwed home. Approximately about 100

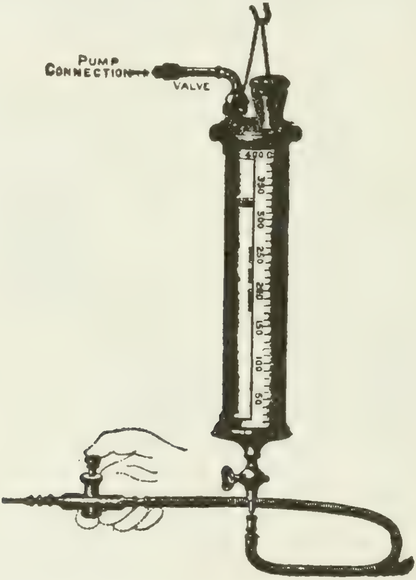

Fig. 7. Pneumatic injector for local anesthesia (Slesinger).

c.c. or more, as shown on the scale on frame, should be left for compression. An ordinary bicycle pump is now screwed on to the valve in the top cap, the tap at base opened, and apparatus pumped up until further pumping is impossible. The tap on the valve is then closed, pump removed, and apparatus is ready. The tap in the bottom cap is opened and a needle attached. When the needle is inserted and the button lightly pressed, fluid will flow in under sufficient pressure to produce even pressure skin anesthesia if desired. The advantages claimed over the syringe method are: (1) It saves a great deal of time; (2) when once prepared will serve for several cases; (3) obviates the tremor of the operator's hand from the pressure used in syringe injections; (4) permits more accurate control of the injection; (5) enables the amount of anesthetic used to be seen at a glance; (6) unlike the syringe, does not break or get out of order easily. A further use is in giving a large number of serum injections rapidly—*e. g.*, antitetanus injections—where flaming the needle between cases is all that is needed.

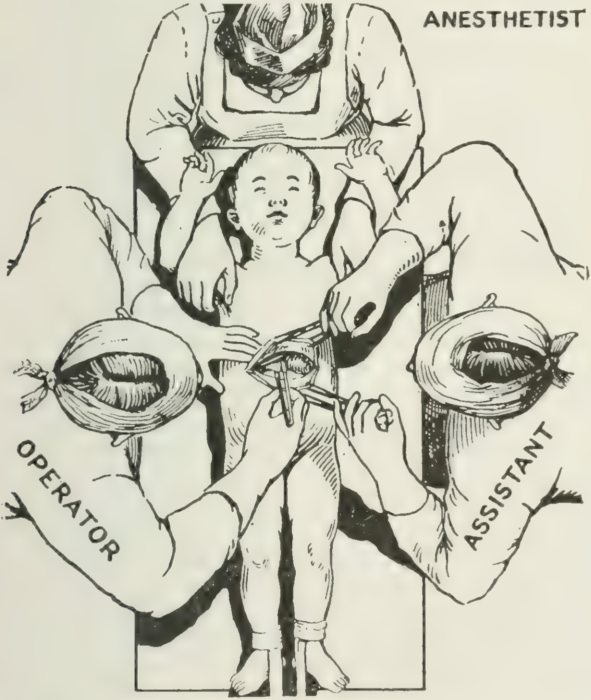

Fig. 8. Controlling children in operations under local anesthesia, anesthetist makes traction on arm (Farr).

[See also Farr's apparatus, 1917 volume—p.30.—Ed.]

Some 77 operations under local anesthesia have been done by R. E. Farr[7] *on children less than 15*, the youngest 2 days. These included 13 appendectomies, 10 radical cures for hernia, 13 removals of cysts, etc.; in but 7 was it necessary to change to general anesthesia. He believes the psychic element is not so important as in adults when operating. Less restraint is necessary during local than during general anesthesia. Much more tact and a more refined technic are required in children than under general anesthesia. The margin of safety possessed by novocain over general anesthetics is as great as in adults. A large percentage of bad risks should have the benefit of this margin. More extensive application of novocain in children is indicated.

In the 1919 volume (p. 30) J. Wiener gives an account of a choledochotomy done under local anesthesia, and in a recent article[8] reports *250 major operations.*

The ideal local anesthetic (1) should be non-toxic; (2) should produce a durable anesthesia; (3) should cause as little local disturbance as possible; (4) should be soluble in water, compatible with adrenalin and sterilizable by heat. Today we have 2 synthetic compounds that stand far above all other anesthetics — novocain made with ethyl alcohol and benzoic acid, and apothesine with propyl alcohol and cinnamic acid. With increasing experience, proper technic, and careful selection of cases, pain can be largely eliminated. And even if not entirely eliminated in some, the lessened danger, fewer postoperative complications, the wonderful difference in postoperative comfort, would weigh in favor of local anesthesia. If we figure 10 or 15 min. to get the patient under ether, the difference in time in many operations will not be marked. One objection is real, it is more trying to operate. There is the additional mental strain of encouraging the patient. It takes months of feeling one's way, before one has acquired the experience and perfected his technic sufficiently to warrant major operations. Much greater care and gentleness must be used in handling the tissues. Added to this is the consciousness that any slight error in technic will cause pain.

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(7) Interstate Med. Jour., February, 1919.

(8) Med. Record, Jan. 25, 1919.

The co-operation of an intelligent patient is a greater help, the reason why so many of his cases were private ones. In any case, we can arrange our day's work so not too many operations under local anesthesia are done at one sitting. Even if it is much more trying to do major operations without general anesthesia, should we not sacrifice our personal comfort for the great advantages that accrue? The answer will in large measure determine the usefulness for each surgeon.

[The greater comfort of the patient following operations performed under local anesthesia, undoubtedly results from the late-effects of the morphia which is given before the administration of the local anesthetic. This can be readily proven by injecting the same amount of morphia in parallel cases, and then operating on one under ether and on the other under local anesthesia.

Our attention was directed to this fact in a number of very slight operations in which we felt that it was not necessary to precede the minor operation with the use of morphin. In all of these cases the wound was far more painful after the effect of the local anesthetic had worn off, than in cases in which it was used. Now we always give the morphin, even in very slight operations. —Ed.]

Technic. Some 45 min. previous morphin 1/4 gr. is given hypodermically. Unless patient appears drowsy this is usually repeated just before operation. Wiener uses a 1 per cent. solution of novocain or apothesine to an ounce to which 5 or 6 drops of 1:1000 solution of epinephrin have been added. Tablets of apothesine with epinephrin are a great convenience. An oz. of the solution usually suffices for a herniotomy or appendicitis. It is true that weaker solutions will often give complete anesthesia. In appendicitis the muscle splitting McBurney incision is particularly well adapted to local anesthesia. Its great advantage is it comes right down on the cecum. Not only is it rarely necessary to pack away the intestines, but there is very little handling of the intestines. The first injection is not under the skin but into the skin along the line of incision. In doing this the skin should be blanched by the solution. As soon as this has been done, pass the needle into the deeper tissues and inject some anesthetic. The advantage of this is that while we are waiting for the skin to become anesthetic some of the deeper tissues are being partially anesthetized. It is very important to have the skin thoroughly anesthetized, so one gain the confidence of patient at the beginning of the operation. After waiting 2 or 3 min. the skin and subcutaneous tissues are divided. Always use a sharp scalpel for dividing all layers, as scissors being blunter are more apt to cause pain. The anesthetic is next injected under the aponeurosis of the ext. oblique and also into int. oblique muscle. After 2 min. both these structures can be painlessly divided. The needle is then passed obliquely under the peritoneum to prevent the possibility of its injuring a coil of intestine and a few drops of anesthetic are injected. After 2 min. the peritoneum is divided. Done in this way there will be no pain up to this point. Both operator and assistants should handle tissues with great gentleness.

[Three points should be borne absolutely in mind in using local anesthesia:

1. Inject into—not under the skin.
2. Use a very sharp knife.
3. Be exceedingly gentle with all manipulations. —Ed.]

As soon as the cecum with appendix is exposed a catgut ligature is passed through the base of mesentery close to appendix. This is not tied, but used as a tractor to draw the base of the appendix into the field. As soon as the base of appendix is exposed the anesthetic is injected freely into its mesentery. Sometimes Wiener waits a min. after injecting the base of mesentery and then pulls on the ligature and exposes the balance of mesentery, which is then anesthetized its entire length. Sometimes it is possible to inject the entire mesenteriolum as soon as the base of appendix is exposed. It is not necessary to anesthetize the mesocecum. A few min. after injecting the mesentery, the appendix can be pulled out, mesentery ligated and divided, and appendix removed with no pain. It is not necessary to inject the base of appendix. Fibrous adhesions are not sensitive and can be readily divided. Omental adhesions are readily anesthetized by injecting a few drops. In a few min. the adhesions can be painlessly ligated and divided. If necessary the tube and ovary can be drawn into wound and resected. The closure in layers is usually painless. Of late Wiener has left a small drain under skin to prevent a collection of serum which sometimes occurs. This is removed at first dressing.

In his earlier herniotomies he blocked the iliohypogastric and inguinal nerves. He now uses the anesthetic in all the layers of the wall. Always injecting some anesthetic into the neck of the sac, usually sensitive.

Including both the acute and chronic cases of appendicitis the *average time* was 22 min. Almost half of the time is waiting for the anesthetic to act. Furthermore, as the patients are conscious all their tissues must be handled much more gently and deliberately. All this time is time consuming, but of great advantage in the after-treatment. While the ordinary operation for appendicitis under ether takes only 12 to 15 min., we must not forget it takes 5 to 10 min. to get the patient under. After all, in operations under local anesthesia, the time is of very little importance. The ordinary inguinal hernia operation takes but little longer than under ether. Two radical amputations of breast for carcinoma, done entirely under local anesthesia, took an hour each, and at the end of that time there was still complete skin anesthesia, so the skin could be painlessly sutured. The longest operation was removal of carcinomatous glands of the neck, this took 90 min.

[There is scarcely an operation in the entire field of general surgery, which we have not been able to perform satisfactorily under local anesthesia, by following the plan laid down in this article.—ED.]

Spinal Analgesia. *Apothesine* for *spinal analgesia* was used in 24 operations by P. J. Kahle.[9] Analgesia has been perfect in all operations, lasting to the completion of each operation, the longest of which was 75 min. Analgesia began within 10 min., except in 3 inguinal adenonectomies and 2 herniotomies, in which it was delayed 4 or 5 min., due to the time necessary for diffusion to the iliohypogastric and inguinal roots. The highest injection was between 11 and 12 D. and the

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(9) New Orleans Med. and Surg. Jour., February, 1919.

lowest between 4 and 5 L. vertebræ. There were no after-results in any case. It is believed that apothesine is a superior analgesic for this purpose and it may be boiled for a short time without impairing its value.

An *extensive experience (8,000 cases)* is narrated by F. S. Rood.[1] Some 250 were done with novocain, but as muscular relaxation was not so good though analgesia was perfect, it was given up and stovain used for the remainder. There were 2 deaths: (I) Obstruction of the small intestine. The patient was very collapsed, there was profuse vomiting, and after the injection a flood of stercoraceous material from the mouth. The respiratory passages were full of vomited matter at the post-mortem.

[It is quite as important to make thorough gastric lavage with water at 110° F., in operating on patients suffering from strangulated hernia—or any other form of mechanical obstruction of the bowel—with local or spinal anesthesias, as when operating under a general anesthesia. This can be done without discomfort, by spraying the pharynx with 4-per cent. cocain, and having patient swallow some of this. The stomach-tube should be left in place throughout the operation in order to carry out any further contents of the intestine which may be forced back into the stomach during the manipulations.—Ed.]

(II) A child of 4 years, more or less moribund, suffering from a gangrenous intussusception. Apparently the fall of blood pressure caused by the stovain, added to the shock already present, was sufficient to cause death. In the light of further experiences these were both instances of a mistaken choice.

The records include patients of all ages, from a few hours up to 80 years. The results with young children were very satisfactory. Once the injection was given they generally passed into a somnolent condition and appeared to be in no way disturbed by the proceedings. The youngest infants were new-born babies with imperforate anus and hernia into umbilical cord. A relatively larger dose is required to produce satisfactory anesthesia in infants than in adults. A dose of 2.5 cg.

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(1) Lancet, Jan. 4, 1919.

of stovain is required for the smallest babies and more for children of 1 or 2 years. Advanced age does not appear to be a contraindication, and many of the patients were between 70 and 80. Elderly people are perhaps a little more liable to syncope if the anesthesia reaches a high level.

The *complications* met with have been: (1) Interference with the respiration, owing to the stovain reaching too high a level; (2) complications due to fall of general blood pressure, syncope, etc.; (3) vomiting. The last seems to be more or less dependent on the weight of the analgesia, common in D. region, rare in L. or S. Headache, vomiting, and pulmonary complications have occasionally followed. Headache was not very common and then slight, but sometimes undoubtedly it was severe. His impression is the headache was more common when patients were conscious during the operation—before a general anesthetic or scopolamin and morphia were used in combination with the stovain. It also seems if the patients were handled very gently after operation, and not jolted on the way back to bed, kept quiet afterwards and not allowed to talk, they were less liable to this symptom. One or two cases of severe headache were almost instantly relieved by lumbar puncture and the withdrawal of about 20 c.c. of cerebrospinal fluid, although this fluid did not appear to be under any abnormal tension. There is evidence to show that spinal is much less frequently followed by pulmonary complications than any other method of anesthesia. It seems that respiratory complications depended more upon the pathologic conditions present, condition of patient, and type of operation performed. Acute septic conditions, as appendicitis and osteomyelitis, were generally present when pneumonia followed the use of stovain. Occasionally there were pulmonary complications after operations upon the upper abdomen, presumably due to a reflex rigidity of the chest and insufficient expansion of the lungs, consequent upon the position of the incision.

Of 10,000 cases in his personal knowledge (2,000 besides his own) Rood states in not one has there been any permanent paralysis of muscles or abolition of sensation, or any trophic lesions, with the exception of 3 cases of paralysis of the external rectus, producing diplopia, which lasted about three weeks. Many of these cases were done by people with no special skill, but the same technic was more or less followed in all cases, so those cases of permanent after-effects which are reported occasionally may be due to some error of technic. These permanent palsies have been more frequent when the puncture has been very low down—viz., between 3d and 4th L. vertebræ. Rood generally made the injection between 11th and 12th D. It is generally easier, and if, directly the needle has passed through the supra- and interspinous ligaments the stylet is removed and it is pushed gently, it is difficult to see how the cord can be damaged, as directly the meninges are entered cerebrospinal fluid appears, and, moreover, the peculiar sensation imparted to the fingers is quite characteristic, much resembling the puncture of tense tissue paper.

The *contraindications* may be very shortly summed up if we say that spinal analgesia should never be administered to patients who are likely, from their condition, to be seriously affected by the fall of blood pressure, which is so often associated with stovain.

It is now long past the experimental stage. Is one of the recognized means of producing anesthesia. Is not a universal anesthetic to be applied to all cases. Has its special dangers. Has its special merits, but used in its proper sphere is a very valuable method.

Spinal analgesia was used by H. Achard[2] *in 413 cases*, 290 with novocain, the rest with stovain. The by-effects may be divided into: Primary, within an hour, hence during the analgesia itself; and secondary, within the 3 days following. The only instances of the former were nausea and vomiting, with an occasional syncopal state. The syncope is much more common with stovain (10%) than with novocain (25%). Nevertheless it is less common than vomiting (10%). Of the secondary by-effects, headache is certainly most common. It generally starts up on the same day as the operation, and reaches its maximum that night, then accompanied by insomnia. It occurs in about 10% with novocain; and in 50% with stovain. Retention of urine, though stated

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(2) Progrès Méd., June 21, 1919.

to be frequent, was seen only 6 times. In 5 it subsided spontaneously in a day with a single catheterization, in the other it lasted 5 days, and ceased with methyl blue.

Leclerc (1918 volume, p. 30) referred to the failures, and Achard divides them into (*A*) Complete failures, more common when the operator first starts use of this method. (*B*) Analgesia not intense enough, this is generally due to only part of the dose being inserted in the meninges. Though in 7 or 8 instances, this was not the cause. (*C*) Analgesia too short. Generally it is obtained in 10 min. and lasts at least 60. The 6 cases of this nature which Achard saw were all with novocain. (*D*) Analgesia limited in extent, this is governed by the position in the 10 min. following the injection. It is imperative that as soon as the drug is injected, the subject be put *flat on the back.*

Accidents and Complications. The *influence of repeated anesthesias on the white blood-count* has been investigated by C. Oliva.[3] Several years ago Richet, the French physiologist, noticed that if dogs were chloroformed, then after the lapse of 2 or 3 weeks rechloroformed, the number of leukocytes was nearly doubled, which he looked on as evidence of indirect anaphylaxis. As a result of the first narcosis there was disaggregation of the albumins of the liver and kidney, and thrown into the circulation, these became true antigens of the blood.

Oliva is a strong advocate of ether, pointing out that chloroform is particularly dangerous because of its affinity for the parenchyma of organs (especially the liver), in which it can be found often very late. He repeated Richet's experiments with ether instead of chloroform. Eight rabbits were anesthetized with ether, and for controls, 4 with chloroform. In 32 days the anesthesia was repeated and the white cells counted every 2 days. The narcoses were kept up for 15 to 30 min., much longer than those of Richet. The findings were constant. With chloroform the leukocytosis was marked by the 2d day, rising till on the 6th or 8th it was double, then decreasing, the most extreme was from 3,800 to 7,750. With ether the average was only 200 to 300, the extreme being from 3,800 to 4,500.

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(3) Il Policlinico, March 15, 1919.

The *subdiaphragmatic route for cardiac massage* i resuscitation from anesthesia has been used in 14 cas by L. E. C. Norbury,[4] with 3 successes. With stoppag of the heart during an abdominal operation no tim should be lost before starting subdiaphragmatic ma sage, and valuable time should not be wasted in th administration of drugs. Artificial respiration and ca diac massage should be carried out simultaneously. I such circumstances a very few compressions will usuall re-establish the beat. If massage be contemplated should be commenced certainly within 5 min. of cardia arrest. He should personally be inclined to resort massage after giving other methods a trial of only 2 mi It may be necessary to continue rhythmic compressio for several min. before spontaneous contractions occu In one temporarily successful case, the heart was ma saged for 30 min. before it could be made to beat; othe measures had been tried for 45 min. Artificial respir tion should be commenced as soon as normal breathin has ceased, and persevered with until spontaneou breathing is re-established. It may be necessary fo some min. after the heart beat has been restored.

In obstinate cases means should be adopted for raisin the blood pressure, either by pressure on the aorta, ban daging extremities, or Crile's pneumatic suit, if this b at hand. Intravenous infusion of weak adrenalin i normal saline is also very efficacious, and will be esp cially applicable where intravenous infusion with salin has already been started before the heart stopped, whe adrenalin can be quickly added. In cases where infusio is not being already carried out this may be done quickl by using the int. saphenous vein (since the arms will b wanted for artificial respiration), or, the common caroti may be exposed and weak adrenalin in normal saline b forcibly injected towards the heart.

Never give up a case of apparent death under an an esthetic as hopeless until cardiac massage and its variou accessories have been given a fair trial.

A case of *death following spinal analgesia* with apoth esin is related by J. Ireland.[6] In a man, of 68, prepa

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(4) Lancet, Oct. 4, 1919.
(6) Jour. Amer. Med. Ass'n, Jan. 3, 1920.

ratory to herniotomy 3 gr. of the drug were injected Jan. 19. Death ensued Feb. 1, after various cerebral phenomena, and necropsy disclosed numerous petechial hemorrhages.

[The alleged relation between cause and effect here is by no means convincing. There were no manifestations for 3 days, and the age of the man with the sclerotic arteries noted on admission, lead one to doubt whether there was anything more than a coincidence.—Ed.]

X-RAY—RADIOTHERAPY.

MM. Roubertis and Nemirovski[7] propose a *new type of fluorescent screen.* The usual coating of platinocyanid of barium is expensive, so they suggest using tungstates, especially that of cadmium. They find there is no permanent phosphorescence, and are not affected by physical or atmospheric agents. With the new screen the object is shown in black on a white background, which renders photography easier.

Extraction of metallic foreign bodies under direct *x*-ray control is described by E. Robin.[8] After ascertaining the position of the body, the patient is placed on a revolving table. Ethyl chlorid will suffice for a short, easy extraction; if liable to be long, or several missiles are to be extracted, or complete immobility is necessary, ether may follow: Anesthesia is always begun when lights are on, and never given in dark except by skilled anesthetist. Iodin is applied to skin, and sterile towels placed. The surgeon when his eyes have become accustomed to the dark, asks for the rays; the radiographer centers the tube and the diaphragms; both look through screen. The surgeon with point of knife on shadow of foreign body asks for red or feeble white light. Then, using his anatomic knowledge, he chooses his avenue of approach, and as a rule makes the puncture a trifle to the right of foreign body, so he may use r. hand to better advantage in moving forceps. The puncture is made, a small buttonhole, not over 1/5 in. long, divides skin, subcutaneous tissue, and fascia. The forceps is now intro-

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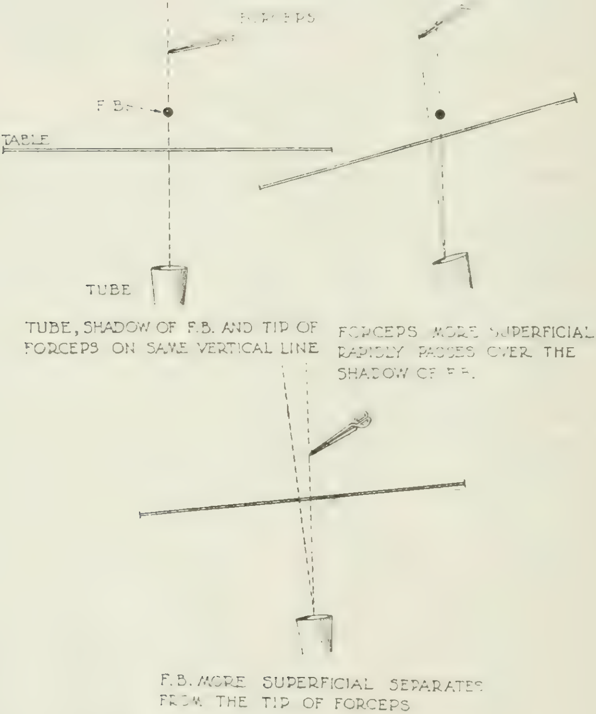
(7) Presse Méd., Aug. 21, 1919.

(8) U. S. Naval Med. Bull., April, 1919.

duced through the puncture in the direction of the body. As a rule, an artery forceps is used. Kocher's forceps may be used but the teeth are liable to catch. Some deep bodies require long bullet forceps.



TUBE, SHADOW OF F.B. AND TIP OF FORCEPS ON SAME VERTICAL LINE

FORCEPS MORE SUPERFICIAL RAPIDLY PASSES OVER THE SHADOW OF F.B.

F.B. MORE SUPERFICIAL SEPARATES FROM THE TIP OF FORCEPS

Fig. 9. Extraction of metallic foreign bodies under direct *x*-ray control (Robin).

The surgeon asks for the rays as soon as the forceps is in the incision, and through the screen he watches it as it penetrates the tissues and he advances it gently but firmly. When the tip reaches the shadow of the foreign body, if the surgeon does not feel or does not see the contact with it, a localizing test must be made to learn whether the tip of the instrument is too deep or too superficial. The surgeon immobilizes his hand on the skin and his forceps in the tissues so each displacement of the table will be transmitted completely to everything lying over it. The radiographer now indicates the direction in which the surgeon is to move, while both of them watch the respective displacements of the shadows. When the tip of forceps and the body are on the same vertical line, if the table be made to rotate, that shadow which moves more rapidly in the direction of the rotation is the more superficial. (Figures.) By one or two rotary movements the surgeon ascertains whether his forceps is too superficial (between the body and skin) or too deep (between the body and table). When once the surgeon's forceps has reached the body he will use it as a grooved stylet to separate the body from the surrounding tissues. After months have elapsed it is included in fibrous tissue. As a rule, this decortication is easily made. When the surgeon has achieved the "metallic contact" and the body is free, he fixes it by pressing it against sound tissue, and, opening the blades of his forceps, he catches it. As a rule, the body is withdrawn with ease, but occasionally a slight twist is necessary to break its last connections with the tissues. No suture is used, merely a dry dressing, removed in 3 days.

This method is simple and very rapid when the surgeon has acquired a little experience. In the soft parts it may be undertaken by any surgeon knowing anatomy. Slight modification permits the surgeon to remove foreign bodies from bones (with curets after trephining the bone); from the brain (after craniotomy).

NEW INSTRUMENTS.

All surgeons have doubtless experienced the inconvenience of having buttons drop off operating suits at inopportune moments. Some may have also found separate trousers a disadvantage. To such W. W. Babcock (1) believes the *one-piece operating suit* illustrated will surely appeal. This is secured by tapes. It is adjustable in size, although in a large service it may be well to provide 2 sizes. It was designed and made by the Atlanta chapter of the Red Cross.

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(1) Jour. Amer. Med. Ass'n, May 17, 1919.

The commercial Esmarch bandages and tourniquets deteriorate rapidly. In using Bier's intravenous local anesthesia, C. Smith[2] found great difficulty in keeping satisfactory rubber bandages. The idea occurred that excellent bandages and tourniquets could be made from *discarded, automobile inner tubes.* Bandages 2 or 3 in. wide may be cut from the tread surface or the valve-stem side of the tube. They are elastic, strong, and above all, durable. The rubber stands boiling well. One bandage used over 2 years still retains its strength and elasticity. Narrow strips make excellent Esmarch tourniquets. (See also Empyema.)

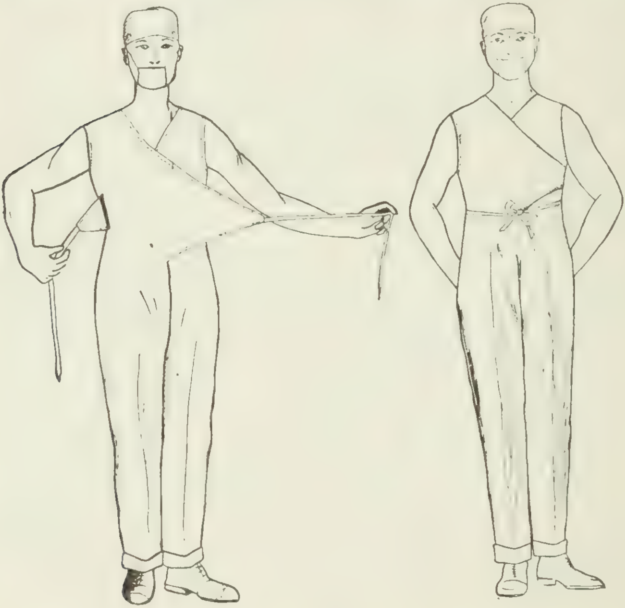

Fig. 10. Manner of securing suit with tapes.
Fig. 11. Manner of tying tapes in front (Babcock).

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(2) Surg., Gynecol. and Obstet., July, 1919.

[This is a variant of the suggestion during the bicycle craze years ago to use these tubes for similar purposes.—Ed.]

The *double-eyed aneurism needle* introduced by A. L. Soresi[3] has the eyes over each other or side-by-side. A thread about 6 in. long is passed through the outside (or upper) hole, and the ends fastened in the spring-catch on the handle. Another thread of equal length is passed through the other hole, and held by the thumb. When the needle is passed through the tissues to be divided, the surgeon should take hold of either one of the threads with a forceps, the assistant taking hold of the other, and then pulling back the needle. In this way, there is no possibility of making a mistake by twisting the threads, and the ligation of any tissue that has to be divided between two ligatures is made easily and rapidly (second figure).

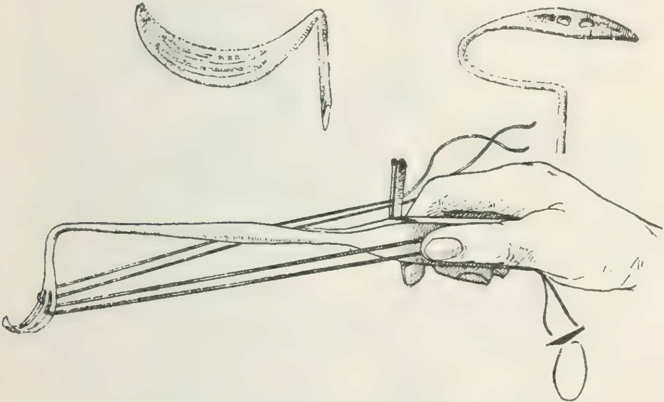

Fig. 12. Double-eyed aneurism needle (Soresi).

The surgeon should use threads of different colors and qualities, particularly in resection of the stomach. While dividing the mesos, linen thread is used on the portion that will be resected, and catgut is used on the ligatures that will remain in the abdomen. With this needle, ligatures and divisions of tissues are more easy: they are

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(3) Annals of Surg., April, 1919.

much more rapid than with the single eyed needle, because the surgeon has not even the trouble of dividing the thread, which at times causes trouble.

Some *needles for work in deep cavities* are described by A. Kahn.[4] As now used needles are fashioned somewhat after an aneurism needle, the thread being passed through a carrier. Both sides of the wound to be sewed must be coaptated onto this long needle or carrier. This is very tedious, for the thread must be carried through both sides held in position by forceps, while the carrier retraces itself to get the ligature through.

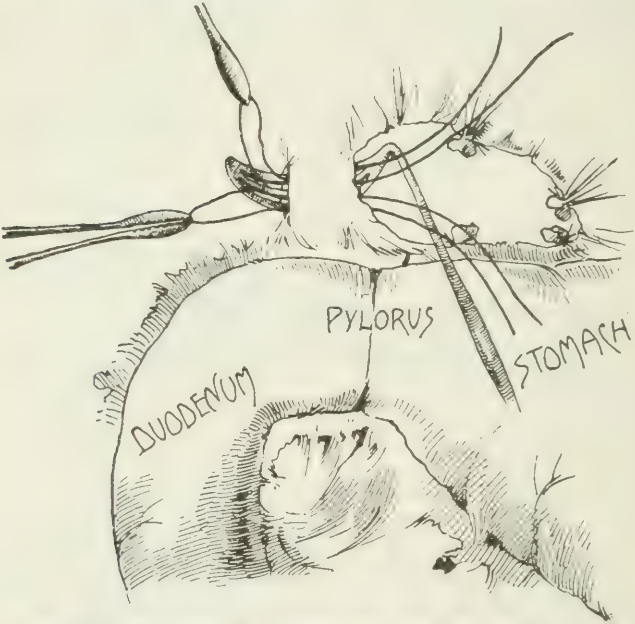

Fig. 13. Same used in division between ligatures (Soresi).

In Kahn's method, 2 needles are used, a female (A) and a male needle (B). The first has 3 needle holes, 1 vertical and 2 horizontally placed; the thread is passed from one side of the needle to the other, across the vertical opening (*A*). The male needle is arranged upon the stylet canula principle. The stylet part is notched, so when the thread is picked off the female needle, the stylet can be drawn up to the canula, the male instrument is now closed, having in effect turned itself into a needle, the notched-point stylet-end now having been closed. As will be seen (*C*), it is now not necessary for either carrier to be itself brought through both edges of wound. The female carrier pierces one side of the wound, the male carrier the opposite side. The male carrier then hooks the thread from the female and pulls it directly through; the stitch is then looped toward the male side. The ligature can now be drawn through and tied; or loop can be cut by scissors, and 2 sutures made instead of one (*D, E, F, G*).

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[4] New York Med. Jour., Nov. 29, 1919.

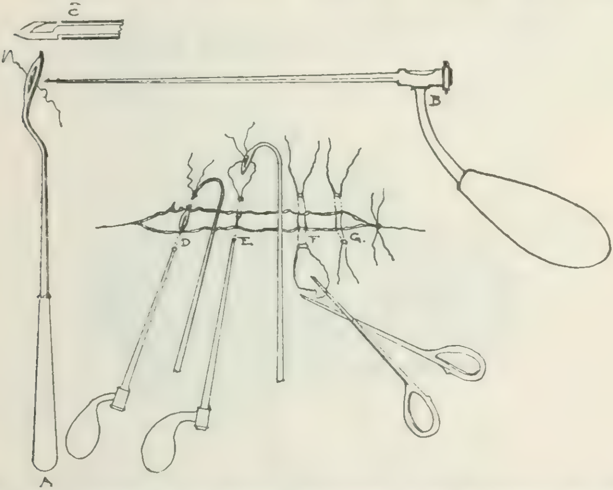

Fig. 14. Diagram of needle for sewing in deep cavities and plan of technic (Kahn).

A *suture-holder* described by H. Whiteford[5] is in the shape of a spring clip. When preparing for an operation, the sutures are threaded loosely in a length of bandage, preferably flannel, about 2 in. longer than the

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(5) Practitioner, June, 1919.

instrument tray. A clip is applied to each end of the piece of bandage, which is then rolled up and placed in the sterilizer. For the operation, the bandage is unrolled and placed across the instrument tray so the clips hang over the edge at each side. In this way the length of bandage is kept taut, and the sutures easily drawn out as required. The clip weighs about 4 oz., and will fit any bandage not over 4 in. wide. It will be found equally useful for needles.

A. L. Soresi[6] points out that in minor operations, when special retractors are not available, ordinary *hairpins may be utilized.* They can be made self-retaining by placing a weight on the end (*g* and *j*). In minor operations they are sometimes ideal: can be widened or narrowed as necessary (*e*, *f*) at different steps of an operation. If the incision should be widened, the points of the pin also can be proportionally widened, without resorting to a change of retractors; even in certain operations when large retractors are needed, the pin can be enlarged to advantage and a second pin put between the branches (*j*). Forceps, held by an assistant, may be attached to the side of the pin that is not bent, and by bending either the points or the top of the pin, one can obtain either a hooked or a blunt retractor. If a very strong retractor is required, pins used to curl the hair should be employed. If sharp pointed retractors are wanted, those with sharp points are selected: if,

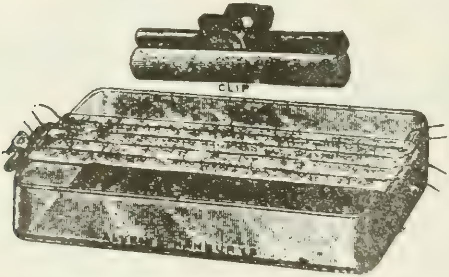

Fig. 15. Suture holder (Whiteford).

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[6] **Jour. Amer. Med. Ass'n, May 10, 1919.**

on the other hand, blunt pointed retractors are preferred, pins having a small knob are utilized (*e, f*). A great advantage of hairpins is they can be bent to follow the curves of the part (*h, i*).

A. K. Henry[7] *also states* he has repeatedly been where

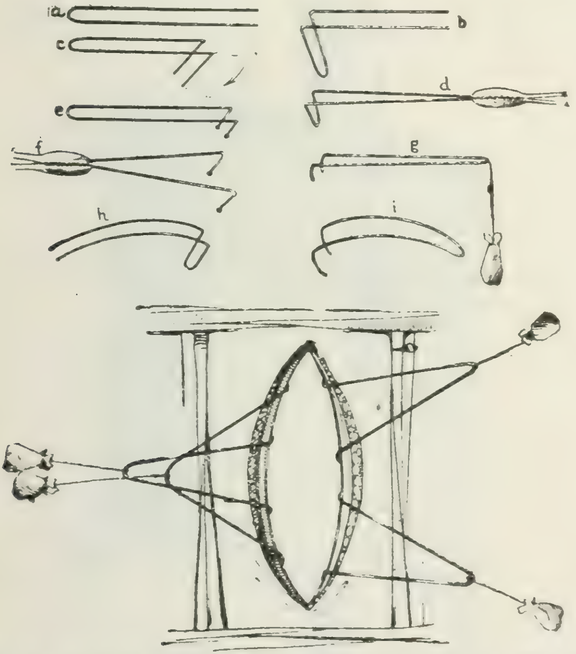

Fig. 16. Ordinary hairpin (*a*) bent so as to form: *b*, a blunt, and *c*, a hooker retractor; *d*, hairpin held on artery forceps; *e*, having small knobs and forming a blunt-pointed retractor; *f*, points more separated so as to form a wider retractor; *g*, self-retaining; *h*, *i*, bent so as to follow the curve of the body; (lower figure) method of applying self-retaining retractors when a large surface has to be retracted (Soresi).

it was necessary to perform those ophthalmic operations which are a part of general surgery—enucleation, *e. g.*, and paracentesis, and where a real lid retractor was not available found an excellent substitute can be made from a stiff hairpin. The middle part of each

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(7) Lancet, Oct. 4, 1919.

limb of the pin is bent to form one of the valves which catches the eyelid. In a lesser extremity, when a syringe has failed to dislodge a foreign body from the ear, and when chance has supplied a speculum, the loop of a fine hairpin (always, of course, under visual control), curved and passed like a hand over the foreign body, will often withdraw it. He also once found the thing useful when obliged to perform tracheotomy with a knife only. A hairpin was bent so the middle thirds of its limbs projected into the tracheal wound and kept it open, while the looped and open ends respectively were fitted to the neck and gave attachment to tapes. This device served until able to procure a tube.

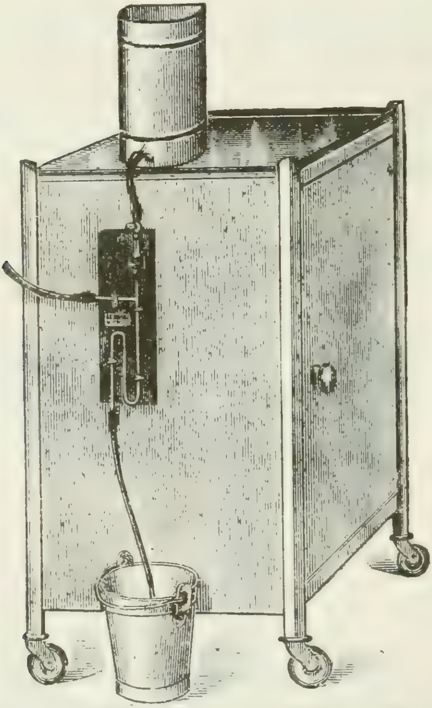

Fig. 17. Modified Cathcart apparatus (Célestin).

The *modified Cathcart apparatus* was devised by L. A. Célestin[9] to cope with the spent fluid in the continuous irrigation of wounds. It consists of a Canny-Ryall dropper connected to a metal T and siphon tube combined, the whole sunk in a wooden block which can be fixed to the patient's locker. The illustration explains the principle. The amount of fluid necessary to create a continuous suction force is 7½ oz. per hour when draining an open cavity, and considerably less when the cavity to be drained is a closed one. It has proved useful in draining appendix and psoas abscesses, the bladder, gall-bladder, and chest, and is made with right- and left-sided blocks from which it is easily removed for sterilisation by boiling.

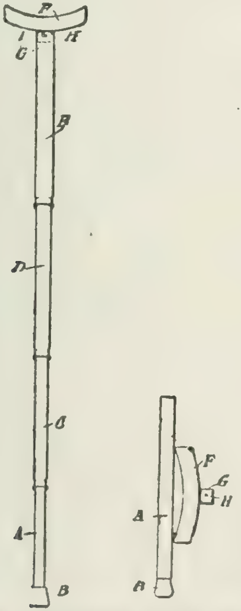

Fig 18. Emergency crutch (Kelly).

An *emergency crutch* is described by R. T. Kelly.[1]

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(9) Lancet, July 12, 1919.
(1) British Med. Jour., March 15, 1919.

In sudden emergency at night, when there is no time to re-apply the artificial limb, the patient is practically helpless. The device consists of 2 or more sections of metal tube, *A, C, D, E,* telescoping to allow extension or contraction. The lower section is shod with a pad of rubber, *B*, and the upper tube of the set has at the end a head, *F,* a solid piece of curved wood or metal, supplied with a pad to give support beneath the armpit. The sections can be extended instantly, so the crutch can be brought into use at a moment's notice, and then locked by a self-acting catch. When not in use it takes up little room. The head-piece, *F*, has a spigot, *G,* and is locked by a pin, *H*, engaging a bayonet slot, *I.*

A simple and effective *apparatus to assist in the restoration of supination and pronation* in wounded or stiffened joints of the forearm, J. I. Palmer[2] calls a "tensor," whereby a continuous pull may be kept up for any required period. It consists of a hook-shape plate to fit over and partially enclose the ulna side of the hand for supination, the plate being modified in its shape to embrace the radial aspect for pronation. A strap, 24 in. long, is attached, the central portion of strong rubber webbing, and the proximal end of the strap is fastened to a buckle secured over the inner or outer condyle with a band of adhesive. It is applied by enclosing the ulnar or radial border of hand—the former for supination and the latter for pronation—in the metal grip and pulling the band round the hand to below the pisiform bone, across the dorsal aspect of the arm to the inner condyle, putting on the strain desired and fastening to the buckle. The spiral is reversed, of course, for pronation. A continuous and not uncomfortable pull is attained and the using of the hand is scarcely impeded. With a modification it is useful in flat-foot or where a deformity requires correction. In torticollis with a cap

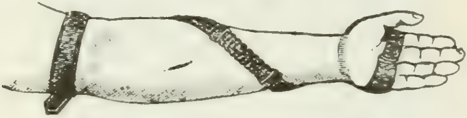
Fig. 19. "Tensor" (Palmer).

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[2] Lancet, May 10, 1919.

fitted round the forehead it is effective, as in many conditions where a continuous opposing strain is desired.

ASEPSIS-ANTISEPSIS.

Discussing the *influence of some of the modern antiseptics*, H. S. Stacy[3] remarks that probably most surgeons felt like himself, until several years ago, that if there was anything soundly established in the treatment of infected wounds, it was dependent drainage and the use of such antiseptics as carbolic, biniodid and bichlorid, etc. Yet these ideas received a rude setback during the war, firstly by the partial success of the hypertonic salt pack introduced by Gray, and later by the frequent instillation into the wound (in which dependent drainage was deliberately avoided) of the hypochlorites (Carrel-Dakin). By their researches they have evolved a method which, though capable of being improved upon, will, without doubt, serve as a sound basis for the future in a good percentage of infected wounds.

In Stacy's opinion, for a wound up to 12 or even 24 hours after its infliction there is nothing so expeditious as excision and primary suture; to excision may be added application of *Spir. vini meth.* and then "bipp," or even the spirit alone; undoubtedly the crucial point is the excision. This, in compound fractures, would include removal of a small area of bone around the fracture; in penetrating gunshot wounds of the skull best done by excising the punctured portion entire by drilling around the opening; this is preferable to nibbling with rongeurs, which may spread the infection. There are many compound fractures in civil practice that do well merely by excision of the wound of the soft tissues, or by treatment by an antiseptic *e. g.*, iodin, yet there are occasions when one regrets not having carried out the technic in its entirety, for sepsis once established in bone is exceedingly slow to eradicate.

But to get proper results from these modern antiseptics we must not apply them as formerly—an occasional irrigation, in which one may confidently assert

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(3) **Med. Jour. Australia, Feb. 15, 1919.**

recovery was due to other procedures simultaneously adopted (notably, drainage and relief of tension), rather than to the antiseptic; of course, where an infected wound was exposed to gauze wet with antiseptic and frequently changed, the antiseptic was important.

The very basis of the treatment is to abolish dependent drainage and so contrive the wound will act as a cup in which the antiseptic may be poured and remain in contact with its walls until it is renewed in 2 hours' time (the usual time adopted); in severe infection this is reduced to an hour. Hence, if the wound is made by the surgeon and he either encounters or fears sepsis, he will so place it that, if possible, it will be on the ventral surface; this will allow the patient to lie on his back during the after-treatment. Naturally, in many this is impossible. If made laterally, the patient will lie on the other side; if dorsally he will lie as much as possible on the ventral surface of limb or trunk (as the case may be). But the dorsally-placed wound often makes it impossible to apply the antiseptic continuously; one has to pack the wound with gauze around the tube, to retain some of the lotion. The dorsal incision is a real drawback in arthroplasty of the elbow for bony ankylosis following gunshot wounds. In these cases a certain amount of sepsis usually lights up again. In sewing up, sutures will be so placed the tube conveying the lotion comes out of the uppermost end of the wound, the lowermost being closed. If not inflicted by the surgeon, the same principles should be observed; but it may be more feasible to use dependent drainage.

Best of all is excision of the wound track, with its blood clot and necrotic tissue, and, if necessary, the laying open of vascular sheaths, into which blood may have been effused; but this is only feasible if less than 24 hours old. After this period the micro-organisms have got beyond the track into lymph spaces or even into the lymphatics. The tube used to convey the antiseptic is the ordinary red rubber one of Carrel, with an interior diameter of $^{1}/_{6}$ in., but wounds in civilian surgery are seldom of great extent, and rarely require more than 1 or 2 tubes, having a terminal and a lateral opening. (The typical Carrel tubes are not often necessary.) It is well to pack moist gauze lightly around the tube at the mouth of the wound. On several occasions, when a wound was not cleaning up, Stacy found the greater part of the lotion was escaping outside the wound, through using a Carrel tube with multiple perforations, one or more of which were external. Another point is if 2 tubes are used from the same conductor, one must not have multiple minute perforations and the other an open end, otherwise all the fluid will come out of the latter. Another flaw may be due to one section of the wound being partly walled off from the antiseptic. It is important to protect the skin around with vaseline.

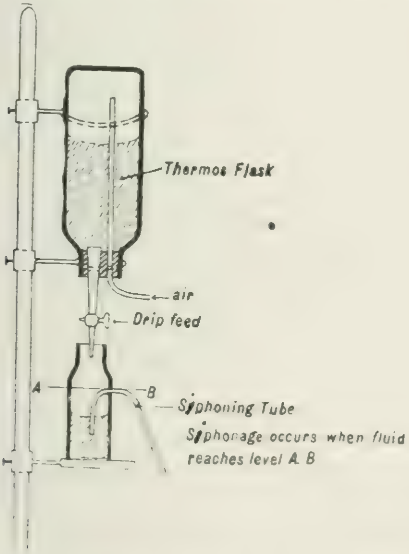

Fig. 20. Method of automatic irrigation for Carrel treatment (Reader)

An effective *method of storing Dakin's solution* so N. Reader[4] states is in a thermos flask. A solution tested 2 months after preparation showed no deterioration. A convenient apparatus for producing intermittent irrigation is shown in the sketch. The lower bottle

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(4) Indian Med. Gaz., November, 1918.

may be made out of an ordinary one of 20 or 30 c.c. capacity by heating in a blowflame the side of the bottle above the centre and pulling the molten glass out with forceps. When the protruding glass is broken off, a hole is left, and this may be enlarged to the required size by again heating and working round a metal rod. A piece of rubber tubing which fits the hole tightly forms a sufficiently watertight joint. The drop feed may be arranged to give a syphonage every 2 hours or oftener as required. When pus is present in a wound there is no danger of injuring the skin with Dakin's solution, but should protection be required this may be provided by applying a coarsely-meshed fabric previously soaked in melted vaseline and cut to fit the part exactly.

C. L. Gibson[5] calls attention to the *advantages of picric acid over iodin.* In 1910, after using iodin for a year, he advocated it. But soon after he had several cases where the iodin produced very disagreeable caustic effects, he abandoned it for a time. Later on, he returned to it, washing off with alcohol at end of operation. While the caustic effect was lessened, some cases gave a great deal of annoyance.

In 1917, at a C. C. S., Gibson became familiar with a 5-per cent. alcoholic solution of picric acid. After use in 100 consecutive cases at the N. Y. Hospital, in no one has there been the slightest tendency to skin irritation. This solution has all the advantages of iodin, and none of its drawbacks, also very cheap. Prior to use the skin can be shaved with soap lather and scrubbed with soap and water as much as desired. The same precaution should be exercised as with iodin—the skin is allowed to dry before operation is begun.

The *healing of wounds with chinosol and salt* is considered by W. C. Lusk.[6] *In vitro*, the former though a powerful antiseptic is very little germicidal; a 2-per cent. solution did not kill *S. aureus* in 24 hours. Its disinfectant action on vitalized tissues is therefore probably due to the excitement by it of physiologic stimuli to bring Nature's forces of resistance to the fore.

A chinosol ointment and a tr. of chinosol have im-

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(5) Annals of Surg., February, 1919.
(6) Ibid., May, 1919.

portant uses. The ointment (chinosol gr. vi, sodium chlorid gr. ii, lanolin and vaseline āā ℥ss) rubbed in 4 or 5 min. once in two or three hours, has proved a pretty reliable agent to abort beginning hair-follicle infections. The tincture (chinosol, 2 per cent., and sodium chlorid gr. iss to the ounce in 80 per cent. alcohol) applied once a day to the skin around a furuncle, after having removed the grease with a fat-solvent, will prevent infection of neighboring hair follicles.

The technic is simple, application of the chinosol-salt aqueous solution in suppurating and granulating wounds which are accessible being by gauze which, when the wounds are discharging, is left in place between daily dressings, but when the wounds begin to granulate healthily with little discharge, should be removed in two or three hours following the dressing, to permit collapse of the wounds. The solutions used in this class contain 2 per cent. of chinosol with either 0.85 or 5 per cent. of sodium chlorid. The combination of this strength of chinosol with the hypertonic salt probably promotes cicatrization to a greater degree than does that with the isotonic salt, while the latter probably promotes the growth of granulations more than does the former. These solutions cause a burning sensation which quickly passes away.

The healing of blind tracks of soft parts may be facilitated by injecting the tracks once in six or eight hours through tubes having no punctures, introduced to their bottoms, for which purpose the 2-per cent. chinosol—5 per cent. salt is probably preferable. The tincture has seemed particularly advantageous for the healing of blind fistulæ in ano, though with a different technic, it being injected into the track two or three times at 15 to 30 min. intervals each day.

For control of sepsis in a draining empyema, the 2-per cent. chinosol with 5-per cent. sodium chlorid is recommended, 1 oz. of which may be injected daily, to be retained by posture, following preliminary washing with salt solution. In one case a 5-per cent. salt solution for the preliminary washing seemed to avail more toward healing than had normal saline. Wright has shown that a preliminary wash of a pus-secreting surface with salt solution to remove the albuminous substances, gives an after-coming antiseptic an opportunity to reach the bacteria. Before dressing a wound, the surrounding skin is first wiped with McDonald's solution (alcohol 60, acetone 40 parts, to which 2 per cent. of pyxol is added).

First-aid treatment is effected by packing with gauze saturated with chinosol iv grains to the ounce and 0.85 per cent. sodium chlorid, which may be left for 24 hours before repairing or redressing the wound, when the same should be used again, or by simply sponging freely with the solution during the operation for its immediate repair. The above gauze pack, after remaining in a fresh wound for 24 hours, often adheres to well-nourished tissues. Hypertonic salt should not be used in a fresh wound which is to be sutured.

In both old and fresh wounds which gape, it is advisable to interpose rubber tissue between the gauze which brings the solution into contact with the wound and the external dressings, to prevent abstraction of the solution into the latter. Lusk summarizes the merits of chinosol as: Its stability, ease of application, applicability to first-aid treatment, tendency to dry up pus, non-irritability when applied in accordance with the technic advocated, unless possibly after prolonged use; also the facts it appears not to attack tendons and facilitates the separation of sloughs.

R. Waterhouse[7] states liquid paraffin which boils at 680° F., is very convenient for *disinfecting needles and syringes* used for exploring, etc. A simple method is to heat a test tube $^3/_4$ full of the paraffin until currents appear (indicating about 302° F.) or rather longer, draw the heated fluid at once into the syringe until it comes in contact with the whole of its interior, and then eject it. Over 6 years' experience has convinced the author of the rapidity with which complete sterilization can be effected at the bedside, and the absence of deleterious results on the needle, which never rusts but remains useful so long as kept sharp. The plan is particularly useful for apparatus for intramuscular injections of mercury. Spurting of the paraffin while heating can be prevented by moving the tube up and down.

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(7) British Med. Jour., Aug. 2, 1919.

INFECTED WOUNDS AND THEIR TREATMENT.

While the accounts of military surgery in the Allied armies have been numerous, and often quoted in this and the previous issues of the Surgery volume, *those from Germany* have been very scarce. The Medical Research Committee (England) has compiled[8] an account of wound treatment by 42 authors:

German surgeons started with fixed ideas formed on the teaching of the previous generation (Langenbeck, von Bergmann and Esmarch), the experience of the aseptic system in civil practice, and the expectant methods of the South African war. Their awakening to invariable and inevitable suppuration was rude and early. Marwedel at Aachen found the total mortality rush up from 1.2 per cent. on Aug. 14 to 16.9 per cent. on Oct. 14, and primarily infected wounds rose from 29.1 to 62.2 per cent. In that period the war of movement had given place to stationary warfare, and the number of shell wounds increased; there were delays in transport, and increasingly bad weather. Enderlen at Metz and at Peronne met with extensive suppuration, destruction of tissues, and gas gangrene very early, and apparently made up his mind that more radical methods were necessary. He began to operate for wounds of the intestine in August, 1914, and found that success depended upon operation within ten hours; 67 recoveries out of 154 cases, many with multiple perforations (within what period is not stated), made a good record. In October, he began more thorough treatment of head wounds by raising fragments, removing clots, and drainage.

The active treatment of wounds by incision, excision, and exploration, followed by primary or secondary suture, does not seem to have become general until after Garré had advocated it at the Brussels meeting in 1915. No records, however, were published until 1917, when Hufschmid, Preusse, and Eckert narrated their experiences with 207 cases of wounds of soft parts dealt with by excision and primary suture. There were 11 total failures; 10 in wounds involving muscle, of which class there were 78 cases; all the 78 scalp wounds, including

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(8) British Med. Jour., (Editorial) March 15, 1919.

8 trephinings with uninjured dura, and all but one of the 51 wounds of skin and subcutaneous tissue healed by primary union. Fründ of Bonn stated in October, 1917, that he was doing primary suture of wounds complicated by comminuted fracture of long bones. In 280 cases admitted to a field hospital in six weeks, exclusive of small superficial wounds, 184 were treated by primary suture, with 14 failures; 35 of these were wounds complicated by injury to long bones, and of these 8 were failures; all 4 of the femur cases and 1/3 of the humerus cases were unsuccessful. This surgeon's final method of dealing with the wound was to excise the skin margins, remove piecemeal the lacerated deep structures and irrigate with chlorin water rendered alkaline by addition of soda. This solution demarcated dying from living tissue; at first all the tissues were stained a dirty brown, then vascularized tissue, especially muscle, assumed a bright red color and the devitalized tissue remained brown. It was not a powerful antiseptic, but it promoted hyperemia and thus aided phagocytosis. In comminuted fractures, fragments which were loose or not firmly attached were removed, the wound washed with alkaline chlorin water and sutured without drainage.

If we may judge from these excerpts (the editorial continues) the Germans became alive as soon as other nations to the character and danger of war wounds, and fought hard to combat sepsis and gas gangrene. It is characteristic of the German mind that it sought to explain the action of hypochlorites and other antiseptics by the theory of hyperemia, travelling it would seem, very widely astray in reviving linseed poultices and fomentations instead of recognizing the convincing work of Carrel, and clinical observations of many surgeons by which sterilization of a wound in a given time became almost mathematically certain. The final opinion is there appear to have been no original contributions to the problems of treatment of war wounds.

Some observations were made by H. E. Whittingham[9] on *wound infections* in a Poor Law infirmary. Here it was noticed that certain deep wounds, moderately clean on admission, gradually went from bad to worse in spite

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(9) British Med. Jour., March 15, 1919.

of careful treatment. These cases ultimately developed chronic discharging sinuses, the discharge having a peculiar odor very like that of a bacillary dysentery stool. Several of these patients were obviously suffering from a toxemia; blood cultures were negative. Cultures from wound discharges of 6 of these cases revealed in all an organism identical with Morgan's No. 1 bacillus. This was predominant in most instances, but other organisms were numerous.

That an infection by Morgan's No. 1 bacillus was superimposed on the wounds is evident from the absence of that organism in the 20 cases dealt with on admission, and its presence in 5 at varying periods after admission. The pathogenic action of this organism in wounds is evidenced by the toxic condition and the chronicity of the suppuration as compared with similar wounds from which this bacillus was not recovered; also that under treatment with an autogenous vaccine from this virus the general and local conditions markedly improved. The odor perceptibly diminished in 3 days, and within 10 days a dull and apathetic bed patient would be up with his wound comparatively "clean." The source of infection is uncertain. The question of non-sterile dressings was considered but threw no light on the subject; bacteriologic tests all proved negative. The source was general as cases occurred in wards widely separated, and attended by different medical officers. This point eliminates "carrier" infection. But as the dysentery group of the bacilli, including Morgan's No. 1 has been repeatedly found associated with institutional dysentery in England, the suggestion arises that a Poor Law infirmary is a likely habitat, and infection may have occurred from the dust.

C. E. Nystrum (1) directs attention to *focal infections and their relation to the after-effects of trauma:*

(I) A man injured his hip, with rest for a week he apparently recovered, but soon began to suffer from sciatica of the same side. Treated for 6 weeks without result, on crutches all the time. Mud-baths, etc., also without avail. Finally, 9 months after the accident, a thorough examination disclosed fissure of the anus, of which he had never complained. This healed by dilatation of the sphincter, rest, and 10-per cent. calomel ointment. At time of report (a year later), in best of health.

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(1) Railway Surg. Jour., March, 1919.

(II) Similar case, following fall from a wagon. Another fissure discovered, and treatment resulted in cure of the sciatica, of 6 months' standing.

(III) A woman sustained an injury to her shoulder in October, 1917, which seemed very trifling. Three days elapsed before her attention was drawn to pain in her shoulder; she then decided pain was due to the accident of a few days before. Patient finally became unable to raise her arm, which felt as if ankylosed to scapula; she had joint loosened under anesthesia at La Crosse without obtaining relief. About 7 months later Nystrum did everything he could think of without result, also called two surgeons in consultation; one advised the removal of head of humerus to which she objected. She was then sent to another surgeon who diagnosed neuritis of the nerve to the deltoid from pyorrhea. This was treated and some teeth extracted. Six weeks later she had gained full motion without any pain; in fact, said pain left 2 weeks after extraction.

The well-known effect of *scarlet-red in stimulating the growth of granulation tissue and of epithelium*, is again referred to by A. J. Turner.[3] A woman, *e. g.*, the back of whose hand had been burnt to the 4th degree and who had neglected it for a week, was treated with scarlet red ointment on lint twice a week for 3 weeks. The discharge quickly ceased, the green sloughs disappeared, and the septic pits granulated up. When the skin had extended over the surface no scarring was visible and there was no limitation of movement. In open wounds with considerable loss of tissue an antiseptic paste containing scarlet red powder prevents ugly scarring and crippling contractions, where the latter were not due to nerve lesions.

He began with 8 per cent. strength on alternate days, but subsequently found 2 gr. to the ounce of vaseline, applied daily, was equally effective, and never had occasion to revert to the stronger preparation. If merely to hasten the growth of epithelium a very successful

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(3) Lancet, March 22, 1919.

method is to apply the ointment for 2 days and then a daily hot fomentation for 4 days, repeated *p.r.n.*

The *treatment of sinuses persisting after war wounds* is also discussed by Turner.[4] In 110 cases in which the sinus had persisted from 2 to 17 months, in the majority the track was thoroughly laid open, and the bone exposed so every diseased particle could be scraped away, and all loose bone fragments, or other foreign bodies removed preparatory to the specific treatment. In addition, in the old cases with considerable fibrosis. this fibrous wall was carved out and thickened periosteum removed.

A modification of Morison's "bipp" was used in the very successful postoperative treatment. The modification was partly due to dealing with operative wounds where it was impossible to draw the tissues together with sutures, and where, moreover, Turner was anxious to obtain granulation from the bony surface out to avoid leaving a cavity within, which one could not feel certain was being filled up. With this object, therefore, he added a small amount of scarlet red powder, found of the utmost value for this purpose. But Morison's technic was adopted of drying out the wound with gauze, applying to every crevice methylated spirit, and then gently rubbing in paste very thoroughly over the wound; finally, applying gauze, either dry or moist with spirit, after having painted the surrounding skin with tr. of iodin made with 70 per cent. alcohol. The following combination has exceeded in its antiseptic, cleansing, and stimulating properties the highest hopes:—

Iodoform	½ oz.
Acid salicylic	½ oz.
Scarlet red powder	25 grs.
Liquid paraffin	about ½ oz.

If found a little too dry on rubbing into the tissues with dry gauze, a little additional paraffin may be poured on to the gauze so used.

In some cases a single dressing has been sufficient and has been left on 3 and in certain cases 4 weeks, without the least smell being noticeable. Sometimes there is a

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(4) Edinburgh Med. Jour., April, 1919.

faint oily odor *outside,* not found inside the dressing when opened, and which may, therefore, be neglected. Sometimes blood or slight pus has mixed with the paste and exuded below the dressing: the wool and bandage have then been removed and the dressing replaced with fresh dry, spirit-moistened or carbolic (1 in 20) gauze, or additional gauze, wool and bandage added below to cover the discharge—the results are equally good in either case. Most of the cases have been found in 3 or 4 weeks to have become completely filled up with granulation tissue to the level of skin: where this has been exuberant, it has been touched with nitrate of silver stick and a daily fomentation applied, the epithelium then rapidly growing over. In a few a narrow sinus of varying length was found to persist when, as a rule, the insertion of a small spoon has evacuated a tiny piece of loose bone, or metal, or a tiny area of soft bone; this removed, healing has taken place at once.

Having *used flavine* in both civil and military hospitals—T. E. A. Stowell[5] has shared the disappointment which many surgeons have experienced from a 1 in 1,000 solution in normal saline. The value of purified paraffin as a wound dressing is well recognized, and he sought a combination of paraffin and flavine which would combine the known advantages of the former with those claimed for the latter, and he is much indebted to Mr. Humphreys, for the skill with which he has worked out a stable emulsion.

Acriflavine	0.1
Thymol	0.005
White wax	4.0
Liquid paraffin	76.0
Distilled water	20.0

It is put up in small sterile bottles, stoppered and sealed. The addition of the thymol has given better results in mixed infection, and its presence has not prejudiced the results in the simpler cases.

In dealing with broken-down tuberculous glands, after scraping, Stowell has followed the practice of introducing a small quantity of the emulsion before closing the

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(5) British Med. Jour., March 1, 1919.

wound. It has been his custom for some years, when operating for acute infective abdominal conditions, whenever possible completely to close the peritoneum and trust to the visceral layer to deal with what infection remained after removal of the primary focus. It was always necessary, however, to drain the abdominal wall when there had been soiling of the wound edges. By filling the wound with the emulsion after closing the peritoneum, he found it safe completely to close the wound, and thus avoid the potential incisional hernia which a drainage tube leaves.

The only disadvantage is the price, which works out at about $1.25 for 18 oz. Having in mind the way it expedites recovery, and limits the disability from injury or disease, the saving of man power, particularly in industrial accidents, is such the relative cost is negligible.

It has been the experience of M. Quackenbos[6] that *acriflavine has no special virtue*, compared to the usual nontoxic antiseptics, when employed in the cited indications. Acriflavine's chief value is its remarkable power to stimulate epithelial growth on healthy granulating surfaces. Where Thiersch's skin grafting is indicated, as after amputation of the breast, he recommends the practice of A. J. Couzens of London—wet eusol dressings for 24 to 36 hours, then changing to wet acriflavine dressings, 1:1,000. Healing occurs with great rapidity.

The success obtained by R. A. Stoney[7] by *draining wounds with "bipp" and suturing them,* led him to practice this on a large scale. He uses a modified ointment—2 parts of iodoform, 1 of bismuth, 12 of vaseline, and enough hard paraffin to give the consistency of butter. This never produces symptoms of intoxication, though used in very large quantities.

Much has been written on the distinction between delayed primary and secondary suture, but in this paper the classification is simple. When the skin edges are not excised the operation is delayed primary suture, and when excised it is secondary suture. He found as a rule delayed primary suture could be practiced up to about the seventh or eighth day, after that secondary suture was necessary.

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(6) Jour. Amer. Med. Ass'n, Nov. 22, 1919.

(7) Lancet, June 7, 1919.

The *steps of the operation* are. After cleansing of the wound and surrounding skin with ether and iodin—1. Granulation tissue, if present, is removed from the surface with a sharp curet. 2. The skin edges are separated by blunt dissection all round for a considerable distance, varying with size of wound and loss of tissue; in large wounds it was advisable to separate between the superficial and deep fasciæ to ensure a good blood-supply to the skin. 3. The skin edge all round is removed with sharp scissors, as a rule as economically as possible. 4. The whole wound thus made is dried thoroughly, any bleeding points tied with fine catgut, then swabbed with ether or methylated spirit, and packed for a few moments with gauze wrung out of one or other of these liquids. 5. The wound is completely covered with bipp, which is thoroughly rubbed into the tissues and into all pockets or crevices with gauze, also freely smeared with bipp. 6. The tissues are sutured in layers with catgut so as to obliterate, as far as possible, all dead space; 1, 2, or 3 layers of catgut may be employed to unite the muscles, a separate layer is always used for the deep fascia. These sutures may be either interrupted or continuous, usually the latter. 7. Finally, the skin is united by thick silk impregnated with bipp. Where there is no tension on the skin a continuous suture of fairly fine silk may be used, but where there is tension interrupted sutures of thick silk should be placed about every half-inch, passing through the skin from $\frac{1}{2}$ to 1 in. from the edges of the wound and including the whole depth of the superficial fascia, and it is well to include also a little of the deep fascia. Superficial sutures of silkworm-gut should be placed between the silk, so as to obtain good coaptation. Finally, the wound is dressed with gauze, smeared with bipp, a thick layer of wool, and a tight bandage.

Slight variations may be advisable. *E. g.*, in small wounds the whole wound may be completely excised, or this may be done at least to the superficial part of the wound and the separation of the skin edges undertaken afterwards. In old-standing wounds of a month or more it is advisable to excise the whole wound, or if this is not practicable to dissect away as much as possible of the thick layer of fibrous cicatricial tissue which underlies the granulations.

Post-operation Treatment. Some irregularity of temperature is fairly common after these operations, and if not accompanied by persistent pain does not necessarily mean sepsis (using its clinical and not pathologic sense). If temperature or pain or both continue after the third day the wound should be dressed and possibly 1 or 2 superficial sutures removed to give exit to a mixture of broken-down blood and bipp, seldom or never true pus. On no occasion was it necessary to remove all the stitches, even in the few which suppurated freely. And only quite exceptionally was the removal of a silk suture necessitated. If there is no continued temperature or pain the case need not be dressed till the seventh or eighth day, when the superficial sutures are removed. As a rule, however, in large wounds or where there was much tension on the stitches a practice was made of removing the dressing and looking at the wound on the fourth day. The deep silk sutures should be removed from the tenth to the twelfth day. Where there was considerable tension it was found advisable to keep the edges approximated by strapping for 7 to 10 days after removal of sutures. Stoney found broad mattress silk sutures, even when protected by tubing, did more harm than good. It is far better when there is great tension to content oneself with partial closure of the wound. Experience alone can help to decide how much tension may be used with safety to close the wound. Michel's clips were useless.

	Superficial	Deep, affecting—		Re-amputation	Total
		Muscles	Bones		
Delayed primary suture	10	15	6	0	31
Secondary suture.	13	83	27	5	128

Table I, shows most of the cases were severe. In re-amputations especially is it necessary to operate as early as possible. In the 5 cases there was a slight amount of suppuration in 3, extensive suppuration (which cleared up quickly) in one, and no suppuration in the other, but in all cases they were able to close the stump completely with a sacrifice of not more than 1½ in. of bone, though in every case on admission the bone was either flush or actually projecting.

	Healing by first intention	Slight suppuration	Incompletely closed		Prolonged or abundant suppuration
			Healing by first intention	Slight suppuration	
Delayed primary suture	23 (74.2%)	5 (16.1%)	3 (9.7%)	0	0
Secondary suture	83 (64.8%)	29 (22.7%)	7 (5.5%)	1 (0.8%)	8 (6.2%)

In Table II. are given results classified according to suppuration. Even where suppuration involved the greater part or whole of the wound, or did not clear up quickly, it was never found necessary to remove all the sutures, and the operations greatly shortened the stay. [See also Stoney's paper—Bones.—Ed.]

Ionisation for infected wounds is recommended by F. W. B. Young.[8] *In vitro* electrolysis with sodium chlorid will inhibit growth of Staphylococci with short exposure and low current. To render a culture sterile 10 milliampères for 10 min. is sufficient.

He determined to use sodium chlorid in treating wounds as likely to cause less irritant effect than the metal ions. The average administration was 10 ma. for 20 min. daily, the wound afterwards being dressed with sterile gauze soaked in normal saline. No other antiseptic was used. In a few cases where the edema was very marked one hot pack was applied at night-time. By this means the skin was never rendered sodden.

Six cases were treated and sutured, 4 with success and 1 with only partial success. The last broke down and was evacuated to England owing to pressure on hospital accommodation. Some 12 cases of cellulitis were treated, and were entirely successful. The pain was considerably lessened, and the final result, even when tendon and tendon-sheaths were involved, showed fewer signs of contracting scar tissue than generally occurs following septic infection of the tendon-sheaths. Other types of cases were through gunshot wounds of extremities.

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(8) Lancet, Sept. 20, 1919.

Three cases were treated to prepare for skin-grafting, and in one case periosteum was grafted on an exposed tibia. Four cases in which a joint was exposed and septic were treated, one with complete success. The others (2 elbows and 1 knee) had multiple wounds, and patients so feeble ionisation was not carried out.

Where it was possible to immerse the limb the injured part was placed in a porcelain bath with a carbon electrode. The inert electrode was placed either under the buttocks or strapped to an uninjured limb. Where immersion was impossible several thicknesses of lint were wrung out in 1 per cent. sodium chlorid and Carrel's tubes placed in contact with the wound and covered with the lint, leaving the open end of the tube free. An electrode was then bandaged to the lint. By the tubes it was possible to keep up a fresh solution through a sterile glass syringe while the treatment was carried on.

Young concludes ionisation with chlorin or zinc does not possess any advantage over other methods for sterilising a wound for delayed primary suture. Cases of cellulitis show a marked improvement when treated with ionisation, both in the relief experienced by patient and in the final result, which in every case treated was extremely satisfactory, cicatricial contractures being practically unseen. The fact one septic joint recovered indicates the treatment is well worth trying in similar cases.

Commenting on this, A. R. Friel[9] believes the effects are due to two things—(*a*) the solvent action of anions—*e. g.,* chlorin on exudates and recently formed adhesions and (*b*) to the nutritional changes which the exchange of ions between tissue cells and the fluids of the body in apposition with them produces. To sterilise an open wound directly and within a few min. one will find it necessary to use an ion, such as zinc, which produces a coagulative effect on albuminous substances.

The sterilisation which Young found to occur is to be explained by the facts that as most small bodies—*e. g.,* bacteria are negatively charged they move towards the positive electrode; and that in the immediate neighborhood of the electrode, when this is formed of a substance

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(9) Ibid., Oct. 4, 1919.

with which the ions of the solution do not form a compound, a secondary action takes place when the current is passing, resulting in products, inimical to bacterial life. Thus, supposing the electrode to be of carbon and the solution common salt in water, the ion chlorin will, when it reaches the carbon, give up its charge of electricity and become an atom of chlorin. This immediately attacks the water and seizes the hydrogen, forming HCl, while O is set free. This change, of course, does not occur in the wounds which Young treated, as the tissues intervened between the solution and the metal of the positive electrode. The benefit which so many of Young's patients experienced is an encouragement to others.

A *lactic acid-sugar solution* is highly praised by B. Gheza [1] for use in septic wounds, it puts a stop immediately to all septic fermentation, does not attack the healthy tissues, and quickly excites the reparative process. The solution, which is easily prepared is composed of:

Lactic acid	15
Sugar	250
Water	1000

The manner of use is equally simple, the fundamental principle is not to wait, even till the following day. This is shown in the remarkable series of successes in 10 patients with gas gangrene, all of whom recovered without amputation. A careful toilet is made of the infected segment, many deep incisions are carried down to muscles and even deeper, careful removal is made of all the necrotic tissue, as well as all foreign bodies. The incisions usually in the axis of limb extend as far as sound tissue. Free irrigation is carried out with sterile water, then a large dressing wet in the lactic acid solution applied and not covered with rubber tissue. The dressing is changed twice daily, and general medication (camphor, camphorated oil, etc.) pushed. As a rule, improvement is noted by the 2d day; by the 5th or 6th, even with severely infected wounds, there is found a tendency to repair, with splendid-looking granulations. From now on all that may be necessary is a daily sprin-

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(1) Progrès Méd., July 12, 1919.

kling with powdered lactose. In especially stubborn cases, it may be necessary to make new incisions, repeat the irrigation and the dressing; but ordinarily the best results are had when the dressings are not too energetic.

[The value of sugar in this mixture should not be underestimated, because of its known influence upon many saprophytic microorganisms. Applying granulated sugar to putrid wounds has long been known to destroy the microorganisms causing the putrid odor. This is of value especially in increasing the comfort of patient and his friends in the care of putrid cancers which lose their odor entirely if granulated sugar is applied once or twice daily.—ED.]

Streptococcus Infections. The *habitat and distribution of dangerous streptococci* is considered by D. J. Davis[2]. He remarks that the habitat and distribution outside the body follow quite different rules. There are soil, water, milk bacteria—all dying out quickly when these conditions are essentially altered. Dangerous streptococci, likewise follow similar laws on and in the body. By dangerous is meant primarily the hemolytic streptococci of the human type. Other non-hemolytic varieties are dangerous but, on the whole, less so.

The hemolytic type is the one primarily involved not only in respiratory disease, but in dangerous wound infections. It is the organism that the surgeon primarily fears. These hemolytic streptococci are delicate and evidently not widely distributed. They are highly parasitic and usually die soon after leaving the body. They do not grow well on media and are fond of blood, body fluids and tissues. On the body they are not found normally on the surface. If placed on healthy skin they will disappear in 24 to 48 hours, sooner if the skin is cleansed. On filthy or pathologic skins they may obtain a foothold especially on hairy parts. In the stomach they cannot grow or live, the acid killing them quickly, thus also rendering the intestinal canal relatively free from this variety of streptococci. The appendix normally appears to be practically free of them. Davis is coming to conclude there is normally only one natural habitat for them, namely, the crypts of the faucial ton-

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(2) Illinois Med. Jour., September, 1919.

sils. They live here just as the white staphylococci live in the skin or colon bacilli in the colon. From here by surface extension, by contact and by dissemination of buccal and throat secretions these cocci are distributed to various parts of the body and to other bodies where, should conditions permit, they may develop. Moreover, he has shown that after tonsillectomy these streptococci in the throat are much reduced in frequency. In the small percentage of positives after tonsillectomy their presence may be explained by tonsillar remnants and by chronic infections about the throat, teeth and sinuses. It is possible such streptococci may grow in the adenoids and the lymphoid tissue of pharynx but not as important sources. It is difficult at times to differentiate between primary and secondary invasions of these regions. Endogenous streptococci are constantly present in some focus ready to take advantage of conditions permitting further invasion. They are the strains that commonly cause secondary infections in many wound infections, influenza, etc.

There is another group of hemolytic streptococci which may be called "exogenous." The general properties are quite like the first group but on the whole are of greater virulence, some strains acquiring very high aggressive properties. It is these streptococci which cause epidemics of empyema, of erysipelas, and in surgical wards such at that recently described in a U. S. Naval Hospital. This last began in the nose and throat ward and spread by contact to other surgical wards. Here it was manifested by sore throat, fever, leukocytosis, etc., then by complications involving often regional nodes and sinuses, and especially by metastatic infection in surgical wounds and joints. It was controlled by suspending operations for 3 weeks, immediate isolation of sore throat cases and elimination from surgical service of all "carriers."

The endogenous may possibly become more virulent and aggressive, and thus start an epidemic by contact or otherwise. Perhaps this was the origin of the naval hospital epidemic. In measles epidemics in camps secondary streptococcus infections at first not so virulent may later become more so, and ultimately give rise to primary streptococcus pneumonias and empyemas, without measles or other infections as a predisposing factor.

The streptococcus carrier problem is squarely before us. It is assuming as definite form as is the typhoid carrier problem. It should be the aim of all surgeons, bacteriologists, specialists in whatever line, to make a combined attack for too many streptococcus infections are occurring in all branches of medicine. While many difficulties still present themselves, since we are coming to know the habitat, distribution and natural history of this germ, the outlook appears not altogether hopeless. Thus far vaccination and serum therapy have been disappointing. Perhaps, if more emphasis is laid on elimination from the body, better results will follow.

Concerning *streptococcal infections of septic wounds at a base hospital,* Fleming and Porteous[3] point out there is one type which is predominant. In a series of over 100 septic wounds (fractured femurs) which had remained at a base for over 7 days, this was present in almost every one. In 47 similar cases where streptococci were recovered from the blood, the organism was invariably of this type.

Examinations at a C.C.S. on recently inflicted wounds have shown that in only about 15 per cent. of cases is *S. pyogenes* present. Examinations at the base in cases which have been in more than a week reveal this organism in over 90 per cent. During 1918 they examined a number of the gauze packs removed on arrival at the base. When the patient had been kept at the C.C.S. for over 3 or 4 days *S. pyogenes* was present in almost every case. These cases correspond, therefore, closely with the patients in base hospitals for more than a few days. Where, however, the patient had been sent straight on to the base after excision of the wound they found *Streptococcus* present only in 15 out of 75 cases. Although in the majority of the packs from these recent cases they failed to find *Streptococcus*, they were able to recover other microbes in every case from those portions which came from the depths of the wound, and often in very large numbers.

It has been conclusively demonstrated that *Strepto-*

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(3) Lancet, July 12, 1919.

coccus will grow much better than these other microbes in the blood fluids such as would be found in a recently excised wound, so that had it been present as a primary infection it should have been demonstrable on arrival at the base. It is to be noted, therefore, that on arrival at the C.C.S. 15 per cent. of the men were infected with *Streptococcus;* on arrival at the base (when the cases had been sent straight on after operation) 20 per cent. were infected, but after a stay of a week over 90 per cent. had *Streptococcus.* It would seem that the streptococcal infection of wounds is in most cases a hospital infection, and from one patient to another.

Out of 40 cases of septicemia following compound fracture of the femur they saw only 4 recoveries. The reason for these recoveries is not very evident. All were treated with streptococcus vaccine, but it was very difficult to demonstrate in any of these septicemia cases any direct benefit. So far as we know, streptococci are destroyed in the body by: (1) bactericidal power of the serum; (2) direct bactericidal power of the leucocytes (without phagocytosis); (3) phagocytosis due to the combined action of the serum (opsonic power) and leucocytes. In streptococcal septicemia these are changed from the normal as follows: 1. *Bactericidal power of the serum.* (This is increased.) 2. *Direct bactericidal power of the leucocytes.*—It has been shown that living leucocytes have the power of destroying streptococci without ingesting them. This power is apparently unaltered in septicemia cases except that as there is always a leucocytosis in these cases the power is more manifest. 3. *Phagocytosis.*—In some cases of septicemia the serum has lost completely or almost completely its opsonic power (and also its complementing power). The phagocytic power of the leucocytes is not diminished.

It would appear from these observations that, as a rule, it is not the circulating blood which is at fault in streptococcal septicemia, and in all probability we have to look for some deficiency in the local protective mechanism which allows access of the streptococci to the blood. It would seem to follow, also, that for the successful treatment the most essential element would be the thorough local treatment of the infected focus. It has been observed that when an infection has become circumscribed by the collection of leucocytes in the walls of the wound and by the other factors which operate locally in this connection, it is very difficult to graft a serious streptococcal infection on the wound. It follows from this the utmost care should be taken in the first few days after the injury to keep out the streptococcus and to avoid any treatment which will inhibit the defensive processes developing. In the after-treatment fresh tissue should only be opened up when there is a very urgent necessity.

OPERATIVE TECHNIC.

Value of Military Surgery in Civil Practice. In his address with this title, G. W. Crile[6] calls attention to perhaps the one fundamental lesson that far and away beyond all others became increasingly emphasized during his service with the armies at the front, the field dressing stations, the base hospitals, that there is no basic distinction between the war- and the civilian patient; between the man exhausted by days and weeks of intensive fighting, of tense waiting, of dirt and wet and hunger and thirst, and the starved patient exhausted by the pain and ravages of a devouring disease. In war as in civil surgery the prime problems are the same—shock, hemorrhage, infection.

The experience of this War has demonstrated (1) that spinal anesthesia, nerve blocking, or local anesthesia, each minimizes or prevents shock; (2) nitrous oxid-oxygen minimizes and prevents shock to almost the same degree; (3) when the condition is poor or the operation is to be extensive and long, it is imperative to use nitrous oxid-oxygen with or without local or regional anesthesia. If nitrous oxid-oxygen is not available then, in amputations of the thigh in particular, low spinal anesthesia (Cabot) is the choice; (4) when shock has been established the most efficient treatment is rest, sleep, heat, large quantities of fluid, transfusion, and morphia.

The treatment of infections may be summarized as

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(6) Ohio State Med. Jour., September, 1919.

follows: 1. Before the stage of granulation and new tissue formation, revision of the wound—cutting away all devitalized tissue, removing all foreign bodies, especially clothing, providing free and dependent drainage. 2. Following the above, if the circumstances warrant, immediate or secondary closure as may be indicated. 3. No primary wound closure can be made if the patient is in a state of shock or exhaustion. 4. When the stage of granulation has been reached, free incisions, to relieve tension and to prevent the spread of infection; hot packs; and physiologic rest. 5. In recent wounds and under circumstances in which drainage cannot be established, the Carrel-Dakin method is the choice. 6. In wounds near the surface not showing much recess, dichloramin-T does very well. 7. When necessary to keep the wound free from the increased infection that might occur as a result of the transportation of a man whose wound had been thoroughly revised from the Front to the Base Hospital, then 1 to 1000 sol. of flavine would be the choice; the second is dry gauze and no antiseptic. 8. Infections are treated by raising the local blood supply and local resistance as well as by raising the general resistance. The importance of the latter is frequently forgotten. The increased resistance in the chronic infections is accomplished by adopting as far as possible the dietetic and hygienic treatment for tuberculosis, and by giving transfusions at intervals. The transfusion of blood is the most potent method of increasing the circulation, improving the blood and raising the resistance. As a therapeutic agent it may be repeated a number of times.

N. M. Percy,[7] considering *some phases of war surgery*, remarks that all wounds from missiles are contaminated, the frequency and severity of infection is due to 2 main causes: (1) The presence in the tissues of foreign bodies such as the missile and, above all, pieces of clothing and equipment, which are grossly soiled from the anerobic bacteria of the earth. The fact the various missiles so often carried pieces of clothing into a wound undoubtedly accounts for the frequency and severity of septic complications in the non-treated gun-

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(7) Illinois Med. Jour., September, 1919.

shot wounds. (2) The crushing, tearing and devitalization of the tissues, especially the muscles, with rupture of their vessels, prepares a good culture medium for the contaminating bacteria carried into the wound.

We must look upon all war wounds as being contaminated with bacteria, but a certain time must elapse before these can multiply and develop injurious agents in sufficient amount to produce definite evidence of infection. No limit can be fixed as to the length of time it takes for infection to develop after injury, as the time required for an infection to become fully established depends upon a variety of factors and varies more or less with each individual case. For practical purposes wounds may be placed in two groups: Fresh wounds which although contaminated are not yet the seat of an infection, and the older wounds in which an infection has already been established. Wounds as a rule which come under observation within 6 to 10 hours belong to group one, while those coming under observation at a later period frequently are found to be the seat of an infection. In some instances, wounds not over 6 hours old had developed a virulent infection; on the other hand no definite evidence of infection was present in many 15 to 20 hours after injury. The microscopic examination of fresh wounds reveals very little information of importance. A smear will show a mixture of blood and serum with probably bits of muscle or foreign material and few if any bacteria. A culture from the same wound will show a variety of micro-organisms. Thus in the primary treatment of wounds one has to depend upon the clinical findings rather than the laboratory to guide him in the treatment, especially as to primary closures.

Wounds of the soft parts are the most numerous and can be taken as a basis in the consideration of war surgery. The principal aim in war wounds is to prevent or at least hinder the development of the infectious process. Experience has demonstrated that in wounds which came under observation before the infection has become established, it is possible in the great majority to render them surgically clean and thus prevent infection. This is accomplished by doing a débridement of the wound which consists in: 1. Dissecting anatomically the tract of the missile. 2. Removing the devitalized and torn tissues. 3. Removing the missile and any pieces of clothing. 4. Securing a careful hemostasis.

The closure of the wound may be: By immediate or primary suture; by delayed primary suture; or third, by secondary suture.

Several plans of *marking the skin* have been suggested (*e. g.*, 1915 volume—p. 56, and 1919 volume—p. 39). Another one furnished by W. A. Pusey[8] is to moisten the surface with water from a cotton sponge, and then use an ordinary copying pencil. With this method it is perfectly easy to outline with a distinct violet line any area. Such markings can be made even on a sterile surface by first washing the end in a concentrated bichlorid solution and moistening the surface with a sterile solution. The mark can readily be wiped off with soap and water. (The lines photograph, but not very well.)

[See also Coopernail's method—Blood Vessels.—Ed.]

The value of *calcium chlorid as a hemostatic*, is dwelt on by L. G. Davies.[9] A man, aged 25, had the tonsil removed and declined local or general anesthesia. It was easily removed by a guillotine; bleeding was slight, and the man walked away a few min. afterwards. An hour later he was found somewhat blanched, throwing up clots every few seconds, and with a pail which contained a pint at least. Attempts to localize the bleeding spot only caused more violent retching and gagging with more bleeding, and for the same reason spraying with a styptic also failed. The bleeding was venous, and an attempt to arrest by digital pressure failed for the same reason. At last Davies injected into gluteal muscle a hypodermic syringeful of a 1 to 4 solution of calcium chlorid, following with a similar injection into the other gluteus. The amount of the salt injected was 8 to 10 grains. The effect was striking; the bleeding ceased in 1½ min. and did not recur. A week after he came back with a slight but persistent return of the oozing, which was at once arrested by injecting 4 grains into the gluteus as before; it did not recur.

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(8) Jour. Amer. Med. Ass'n, Nov. 22, 1919.

(9) British Med. Jour., Nov. 8, 1919.

The superficial *jugular veins are advised for intravenous injections* by D. J. Kaliski.[1] In the majority of thin or muscular persons, especially men, the veins at the bend of the elbow are easily visible or palpable and should be chosen. Occasionally after numerous injections these become occluded by thrombosis and are no longer available. In some cases these veins are mere threads and unsuitable for repeated injections. In obese persons, especially women, and occasionally in men and children with poorly developed veins, the operator is at a loss to find a suitable vessel into which to inject.

The patient reclines on a level table. No pillow is used, the head is turned slightly to one side. Compression may be made over the clavicle with the left hand to make the vein stand out more prominently while the right hand grasps the needle and pushes it through into the vein in a downward course in the direction of the axis. After practice almost any needle may be used; but for greater ease of introduction, one with a shield like Kaliski's needle is preferable. For arsphenamin and other therapeutic injections, a needle with a fairly sharp point, not too large bevel, and about 18 to 20 gauge B. & S., 1¼ to 1½ in. long, is most suitable. In introducing the needle, the skin over the vein should be gently drawn up toward the chin. This tends to fix the vein and allow the needle to pierce the anterior wall more easily. The skin is sometimes quite tough, and therefore the needle should not be too large or too blunt. As the needle enters there is a perceptible "give" as the point enters the lumen. It should be advanced about .4 in. If properly in the lumen, there is a slow dropping from the needle, or a drop of blood comes into the hub of the needle (pressure above the clavicle having been removed) and is seen to advance and recede slightly on inspiratory efforts. There is little bleeding from the jugulars compared with that after puncture in the arm.

For the same purpose C. Rosenheck[2] *suggests varicose veins.* In a very obese woman the elbow veins could not be used. He then selected a varicose vein in the leg, which was quite prominent and apparently free in its

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(1) Jour. Amer. Med. Ass'n, May 31, 1919.

(2) Ibid., July 19, 1919.

entire peripheral course. This was injected without incident. The same patient received 2 more injections in the same vein, no local or general reaction. Subsequently 2 other patients with poorly developed veins at the elbow and who fortunately possessed varicose veins were readily injected. Of course it is obvious that success depends on the presence of varicosities in the lower extremities and the selection of one which has not suffered occlusion from a pre-existing phlebitis. As women in the main are prone to varicose veins, these should be made use of for intravenous administration when it is impossible to locate a vein in other localities. If the varicose veins are not very prominent they can readily be made so by constriction above the vein with the cuff of a blood pressure instrument inflated.

As regards *eversion of tissue margins in wound approximation*, C. E. Tennant[3] writes that poor approximation of the margins, and the simple edge-to-edge closure both have a tendency to allow accumulation of serum. With the latter method there is also a tendency to use more catgut, which if ill-chosen actually serves as a foreign body.

The method of eversion is to place a hook tenaculum at each angle of the incision in the layer of tissue to be united, the assistant then elevating the instruments and putting the tissue on the stretch. The layers to be sutured then come well out of the wound, the margins become everted, and with a good strong thumb forceps the operator grasps the everted edge, including both margins, and the needle is engaged in what seems to be one layer of tissue. Either a long straight needle may be used or a curved needle in a holder, but the straight needle does away with the necessity of constantly engaging a needle in a holder and, therefore, saves considerable time. The ordinary over-and-over suture or lock stitch is used for a short distance, the thumb forceps moving along and engaging the tissue just behind the needle. At various intervals along the line a continuous mattress suture is dropped in order to keep the tissues in eversion when they fall back into the wound, and then again the over-and-over suture is applied for

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(3) Colorado Med., September, 1919.

a short distance. These two types of suture are used at various intervals until the layer of tissue is completely approximated. The next layer is then taken up in like manner by the tenacula and put on a stretch and the same technic continued.

With the eversion of all tissues while suturing, there is from 1/8 to 1/4 in. of actual contact of like tissue. With a few stitches inserted in such manner as will hold the margins in this everted position, the double purpose of eversion and approximation is better accomplished: for when these tissues drop back into the normal position the eversion remains and the tissues are absolutely approximated. This makes possible a normal repair with a minimum of new tissue and consequently a shorter convalescence. It is also reasonable to assume this repair may go on so rapidly and the new vessels form so quickly that actual repair is practically attained before suppuration from microorganisms has time to intervene. With the lessening of postoperative low grade infections, or "stitch abscesses," and with the firmer union of the fascia, we should naturally expect less postoperative hernias. With a more perfect apposition of the skin margins it is also reasonable to assume that besides having a more comfortable and less unsightly scar, we are less likely to have the annoying keloid formation. And again, when the parietal peritoneum is everted during the process of closure, there is less probability of postoperative omental or visceral adhesions to the parietal peritoneum, since there is no raw margin exposed within the cavity. As a rule the successful closing of an incision consumes almost 1/3 of the entire time of the operation. If for nothing more, this method can be commended for its time-saving properties.

For *removal of foreign bodies*, A. G. Bettman[4] praises transillumination. Any body that will cast a shadow may be located in a surprisingly short time. Having cut down to the supposed location and having arranged the light, the operator looks through a tube at the tissues, which may be held up or otherwise suitably manipulated. A dark room is unnecessary. When once the body is located, it is a simple matter to remove it. The tube

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(4) Jour. Amer. Med. Ass'n, Sept. 6, 1919.

may be of brass or other metal or a darkened test tube; a roll of paper may be used in an emergency. The angle at which the tube is used may be varied to meet conditions. Even deeply embedded material may be located frequently without the necessity of putting the end of the tube into the wound.

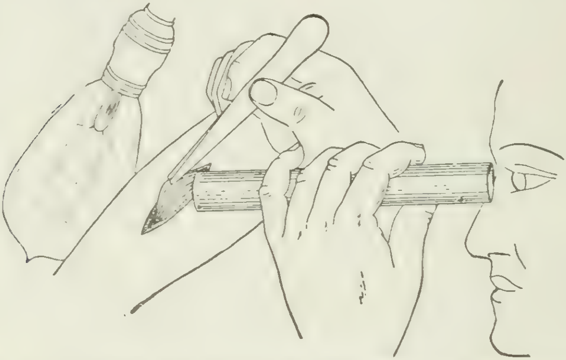

Fig. 21. Location and removal of foreign bodies by transillumination (Bettman).

[See also Robin's method,—X-Ray.—Ed.]

To prevent *adhesions after tendon-suture*, P. C. C. Fenwick[5] wound thick catgut round each tendon as far up as the annular ligament. The wound was then stitched up with salmon gut and the hand placed on a flat splint. Three days after operation the splint was removed and the patient allowed to move his fingers

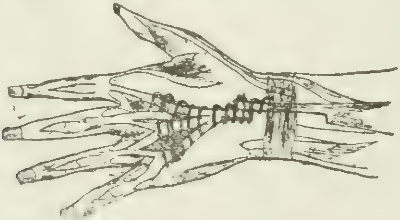

Fig. 22. Prevention of adhesions after tendon-suture (Fenwick).

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(5) British Med. Jour., Nov. 16, 1918.

slightly. A fortnight later faradism was applied to the forearm, and it was found the extensors of the fingers were working well. The incision healed by first intention, but 10 days after operation a small quantity of pus discharged from one of the stitch holes; this soon stopped, and seems to have had no detrimental effect. The patient can now fully extend and flex all his fingers.

The purpose of *the "Grad knot,"* so H. Grad[6] states, is to obtain a secure ligature at all times. A knot when analyzed is found to consist of 2 turns of the string. The integrity of the ligature depends on the firmness with which the first turn of the knot compresses the tissues by its grasp; the second turn merely holds permanently the first turn. It is customary to hold the first turn with thumb force until the second turn is completed; in this manner a firm knot is obtained. With the "Grad" knot the first turn is prevented from slipping in an automatic way. The mechanism is shown in the figures. The first one shows a loop which compresses the first turn automatically. This compression loop *A* is the distinctive feature, as the free ends are pulled taut, *A* falls into place and hugs the first turn. The greater the tension on the free ends, the firmer the grasp of the compression loop on the first turn. The second turn is now carried home at leisure. The knot thus obtained cannot slip or give up the desired compression of tissue.

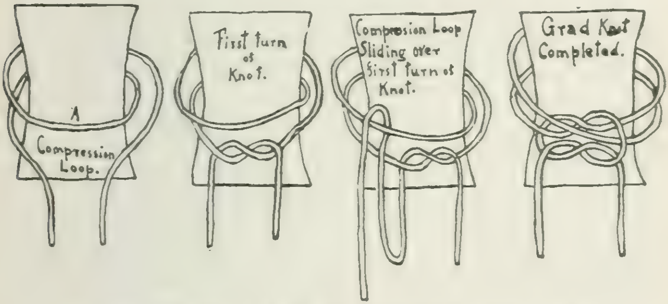

Fig. 23. Manner of tying the compression knot (Grad).

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(6) Amer. Jour. Obstet., March, 1919.

The "Grad knot" is applied very readily. All one has to remember is to create a compression loop. It makes no difference how this is obtained, whether with a needle, ligature carrier, or otherwise. With a ligature carrier the loop can be created with one sweep of the instrument. In places not so accessible a needle may be used and a loop created with 2 stabs. Having created the compression loop, the first turn of the knot is made. The next step is to carry one of the free ends of the ligature under the compression loop, and the free end of the ligature, which is to pass under the compression loop, is determined in the following way: If the first turn of the knot is a right-handed one, the free end of the ligature on the left-hand side is passed under the compression loop. If the knot is a left-handed one, the free end of the ligature on the right side is passed under the compression loop. The first turn of the knot is now tightened, and as the ligature is made taut the compression loop holds the knot automatically and prevents it from relaxing until the second turn is carried home and the knot is completed. It is very necessary to pass the proper free end of the ligature under the compression loop. If the incorrect free end is passed under the loop, an insecure ligature is the result. The last figure shows the correct position of the compression loop. It passes across the first turn and must necessarily compress it firmly, until the second turn completes the knot.

To one using hypodermic needles frequently, the value of some method by which the *lumen can be kept free of rust* and other materials in the shortest time is a distinct advantage over boiling in sodium carbonate, and the use of copper wire, etc. The small pivot broach, used by jewelers to drill very fine holes, permits a needle to be opened very quickly. It is a three-cornered piece of tempered steel with a round handle, the cutting edges act as a drill. It is the size of the lumen, and the same length as the average needle. If the broach is introduced at either end with a semirotary motion, as if drilling, the needle can be entirely freed of rust or other materials. Care, of course, must be exercised as the broach is likely to snap off if forced too hard in the beginning. When the needles are opened by this method, M. H.

Prosperi[7] has found them very satisfactory, and they last almost indefinitely. The broaches can be obtained at a very moderate cost.

To increase the holding property of adhesive plaster, even when of poor quality, A. L. Soresi[8] took the common rubber cement that is used in patching tires, diluted it in about 10 parts of ether, painted the area of skin with it and then applied the plaster as usual after having cleaned and dried the skin. Even the poorest plaster adhered immediately and remained a long time. If the secretion was very abundant, he painted with the same rubber solution the outside of the plaster after the plaster had been applied, so as to make the cloth waterproof by the application of a thin coat of rubber. Incidentally, the same solution with ether has been applied to prepare the skin for operation, instead of iodin.

Grafting and Transplantation. Experience with *secondary suture and skin grafting under local anesthesia* is contributed by J. A. Miller.[9] The preliminary procedure for resuturing or skin grafting was the same. Two days prior the wound was dressed with gauze moistened with 25-per cent. solution of magnesium sulphate. This assisted, to some extent, in bringing any bacteria, deep in the granulation, to the surface by the promotion of an increased exudation of serum. And also in the cases for skin grafting the exuberant granulation tissue was reduced to a firmer consistency, which was essential. At the time of operation care should be taken carefully to wash away from the wound all of the magnesium with sterile saline before proceeding with the sterilization and the anesthetization of the part. Miller used chiefly 2-per cent. novocain or 2-per cent. eucain, to which was added about 15 minims of adrenalin to the 4 oz. at the time of using. In the resuturing of wounds he infiltrated the entire circumference superficially and deeply, and under the granulation tissue covering the wound, the needle penetrating from the surrounding edges which had already been anesthetized.

Most patients felt no pain after the first injection, if the line of infiltration was followed around the wound

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(7) Jour. Amer. Med. Ass'n, Aug. 16, 1919.
(8) Ibid., Sept. 6, 1919.
(9) New York Med. Jour., May 3, 1919.

carefully. The next injection was always started just within the edge of the last infiltrated portion. In skin grafting the entire area was anesthetized intradermally instead of subcutaneously. An area of skin which was calculated, usually by experience, sufficiently large to give the required amount of skin necessary to cover the wound, was anesthetized in this way, remembering, as in the deep injection, to start the new insertion of the needle within the last anesthetized area. The pain was thus absolutely eliminated. After the entire portion of skin to be used has been treated in this fashion, the skin was picked up by a needle and cut off with a sharp scalpel, bit by bit, each piece about the size of a small split pea, and laid on the wound to be covered. By this method a great covering area can be obtained from a relatively small skin area, roughly speaking, about half the size of the wound to be covered by the graft. It is much slower than other methods, but more efficacious. The amount of novocain or eucain used was often as much as 6 oz. of the 2-per cent. solution, and never did any of the men experience any toxic effects. In 2 cases of skin grafting, the areas from which the skin was obtained became infected. The graft itself did not. In the resuturing of wounds in this manner the ordinary technic was followed of swabbing out the excised area with alcohol and then rubbing in "bipp" and closing the wound with silkworm-gut.

Moss' principle of *blood grouping has been applied to skin grafting* by H. K. Shawan.[1] Based on the interaction of serum or plasma and red cells, each individual is placed in one of 4 groups.

Group I.	Serum agglutinates corpuscles of no person. Corpuscles are agglutinated by serum of II, III and IV.
Group II.	Serum agglutinates corpuscles of I and III. Corpuscles are agglutinated by serum of III and IV.
Group III.	Serum agglutinates corpuscles of I and II. Corpuscles are agglutinated by serum of II and IV.
Group IV.	Serum agglutinates corpuscles of I, II and III. Corpuscles are agglutinated by serum of no person.

I and III are rare groups; II and IV are common. The relative incidence, as found by Karsner in 1000 groupings, was:

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(1) Amer. Jour. Med. Sci., April, 1919.

Group I, 3.1 per cent.; II, 42.4 per cent.; III, 8.3 per cent.; IV., 46.2 per cent.

Some 17 patients were successfully grafted with sections of skin from each of the groups and with autografts. Of these cases, 2 were members of Group I, 8 were in II, 2 in III, and 5 in IV.

As a result Shawan concludes autografts grow best. Isografts obtained from donors of the same group as the recipient or from Group IV donors became permanent takes and grew almost if not equally as well as autografts. Isografts where the donor and recipient were of different groups were not permanent except when IV skin was used or the recipient was a member of I. Group I recipients grew permanent skin from donors of all groups and apparently equally well. Group IV skin grew permanently on recipients of all groups, but only IV grafts and autografts remained as permanent takes on IV recipients. It appears that skin grafting obeys the principle of blood grouping, as in transfusion.

A note on *immunized skin-grafts* is furnished by A. L. Yates.[2] German writers described a process of rendering the skin immune to the toxins in the wound for which the graft was intended, and claimed if immunized skin was employed the growth of epithelium was quicker and more certain. The method consists of placing the dressing which has been in contact with the surface of wound, and therefore soaked in the discharges of wound, upon an area suitable for obtaining Thiersch grafts and allowing it to remain for 24 hours, after which it is replaced by another dressing removed from contact with the wound. It was found necessary to moisten dressings on which the discharges had dried and to mark out the skin for the graft by nitrate of silver. Applied with these precautions, the skin was found to redden and to show on the third day a slight prominence of the papillæ. It was necessary to watch the skin carefully at this point, as it is important to guard against a violent reaction. When the skin showed a marked elevation of the papillæ and slight reddening the treatment was stopped for a day, but in most it was possible to treat for 7 days, after which the graft was

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(2) Lancet, Aug. 23, 1919.

ready for removal. The severity of the reaction varied within rather wide limits, and in a few cases no reaction occurred. This was thought to indicate the skin already possessed immunity, and to a certain extent this view was borne out by the graft taking readily.

The following technic gave the most satisfactory results. The granulations were rubbed with dry unmedicated gauze and the graft removed by Thiersch's method, applied, and well pressed down. Then covered with waterproof tissue, in which a number of holes of about $\frac{1}{8}$ in. had been cut, and the opposite edges of this tissue were fixed to the skin with adhesive. This was then covered with unmedicated gauze and wool, and bandaged in position. The wound examined every second or third day and any discharge removed by gently syringing through the tissue, which was not otherwise disturbed.

Yates had no failures, though he only treated 27 cases, and but 3 had failed by the ordinary methods. Of these 27 cases, 10 were ecthyma, where deep ulcers had developed and had resisted treatment for several weeks previously, 13 were infected lacerations, where healing was delayed for several weeks, and 4 were chronic ulcers, which had resisted treatment for a long time. In several a certain amount of movement was allowed, and all in which walking with a fresh graft applied to some part of the lower limb was permitted, the graft took without any difficulty. Local anesthesia was employed in all cases, and in the ulcers it also was anesthetised and the thickened base punctured with a needle.

Grafts of dead tissues have been successfully resorted to by Nageotte and Sencert.[3] A dead graft of connective tissue provided it be permeable, *i. e.*, its structure allows the emigration of the connective tissue cells of the host, regains its vitality entirely in a short time. In the contrary case, it becomes adapted to new circumstances, the connective tissue framework persists, after the dead protoplasm has been carried off by these migratory cells; the fibroblasts from the host become installed in the persistent connective structure; circulation is re-established and soon it is impossible to tell by histologic examina-

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(3) Presse Méd., Dec. 9, 1918.

tion that the graft was dead when introduced. Using grafts preserved in alcohol or formalin they found these did not cause any reaction about them when asepsis was maintained, that they join with the host by direct union and not by intermediate formation of new tissue; that the divided ends of the connective fibres of the graft join, by a purely physical phenomenon, to the similar extremities of the fibres in the host, and that cellular repair begins very shortly. The new cells come from the fibroblasts, which are already adult when they make their appearance, they ramify among the interstices of the graft, beginning at periphery and spreading to the center.

A knowledge of these facts led them to see whether grafts large enough to repair rather extensive losses of substance in organs made up of connective tissue, *e. g.*, tendons, would behave the same as the small fragments used hitherto. All their animal experiments—at first with tendons, then with arteries—were entirely successful. Some of their results were very promising, replacement of a segment of common carotid with a similar piece kept in alcohol for a month, and a patch of the abdominal aorta with a piece also preserved for a month. At first they had physiologic thrombosis in the vessei work, but with more perfect technic have overcome this.

Grafts of adipose tissue are recommended by W. Dubreuilh.[4] He remarks that vicious cicatrices after war wounds are very common both on the face and limbs. Often a narrow and deep cleft adheres to the bones or the muscles, impeding motion, slowing the circulation in the lymphatics, and unsightly on the face and often on the limbs. In addition the cutaneous secretions may cause maceration and inflammation at the bottom of these crevices which are difficult to keep clean.

A few years ago paraffin was much recommended, but Dubreuilh states it is only suited for raising a mobile skin, and is useless in scar tissue. Furthermore, when used by others he has never seen any satisfactory results.

The adipose graft (of Chaput) is a true repair, not introduction of a foreign body which may be displaced or eliminated. The author has been able to apply these

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(4) Jour. de Méd. de Bordeaux, Feb. 15, 1919.

grafts in many cases during a period of 2 years. Most of them were removed with local anesthesia. The best site is the anterior or external part of thigh. Through a short incision a piece of fatty tissue may be removed the size of the finger and of appropriate length, it should always be taken when needed, not before and then kept. No grafting is to be done till cicatrization is complete, the slightest infection is sure to cause elimination. It is not necessary to excise all of the scar, though the superficial layer should be removed, the remainder will be gradually absorbed. However, the nearby skin must be loosened up so manipulations will be easy.

To close the incision Dubreuilh uses a buried intradermic suture with fine gut, what he calls the ''shoelace suture,'' with 2 ends crossing zig-zag and interlacing. This is difficult to carry out over the slippery mass of fat, so it is better to insert the stitches leaving them loose, then introduce the fatty graft, and tighten the ends of suture. If the latter is very long it is better to make a knot about every 4 stitches, which gives more solidity, and if the stitch should give way, not all of the graft will be lost. It is quite possible that part or all of the fat cells will disappear, and nothing be left but the loose connective framework, and this may ensue possibly even in the most successful cases. Nevertheless, the hard, depressed and adherent scar becomes supple, mobile and on a level with the adjoining tissues, thanks to the connective tissue padding and lymph drainage may be re-established.

After experience in over 100 cases, E. G. Beck(5) advocates the *adhesive plaster method* for the rapid regeneration of skin over granulating wounds. It may be applied in all types, whether these be due to ulceration, burns, or trauma, and especially wounds produced by surgical operations. Perhaps the most important field is over denuded surfaces produced in skin sliding. This method is now widely employed in the apparently hopeless chronic suppurations of bones and joints, empyema, and lung abscess.

The technic consists in applying strips of plain or Z O adhesive along the edges of the wound. These strips,

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(5) Annals of Surg., March, 1919.

½ to ¾ in. wide, must be so adjusted they cover both margins, that of the skin and of the granulated wound. This leaves the center exposed for absorption of the secretions by a dry sterile dressing. Twenty-four hours later the dressing and adhesive are carefully removed. It will be found along the margin of the skin there has now formed a bluish-gray border, about 2 or 3 mm. in width, which represents the new epithelial cells. The wound is now dressed with dry gauze, which is left on 24 hours, followed on the next day by another application of adhesive, and repeated until the entire surface is covered with an epithelial growth. All necrotic tissue must be allowed to slough off, so the base of the wound is clean, before we can expect the epithelium to grow. The wound must never be rubbed with gauze, as this would destroy the new cells.

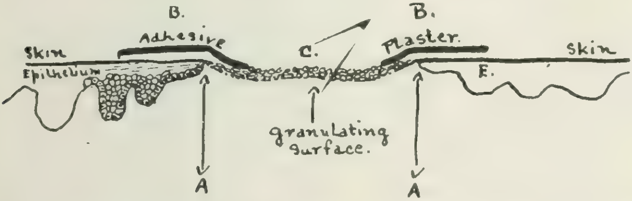

Fig. 24. *AA*, margin of epithelium bordering on granulating surface. *BB*, adhesive covering both margins, skin and granulations. *C*, exposed granulating surface (Beck).

A frequent mistake is to draw the surfaces together with the adhesive strips. This is not the intention. The edges should be kept apart as much as possible, so the skin may grow along a flat surface. When the skin grows into very deep recesses, so the skin surfaces are in contact, we are likely to produce a pocket in which the secretions would accumulate and undergo decomposition. To prevent this, we must plan our operations so as to produce a funnel-shaped depression which can be properly ventilated. The epithelial covering thus produced is only in appearance somewhat different from normal skin, but serves practically the same purpose as a skin transplant.

AMPUTATIONS.

The "Guillotine" Amputation. So many modifications have been used, depending on the available tissue, that T. G. Orr[6] believes it wiser to include under this term all no-flap amputations. The guillotine operation will doubtless be used in selected cases in civil practice. Many surgeons can look back upon cases of serious infection where amputation was not permitted until all hope for life had vanished without it, and when done the patient died because of continued progress of the infection. In such cases and in the presence of gas infection the guillotine should be the choice in the future.

U. S. GENERAL HOSPITAL NO. 26.

Total number of overseas cases amputated	335	
Total number of guillotine amputations	199	or 59 per cent.
Number of healed guillotines on admission	58	or 30 per cent.
Number of unhealed guillotines on admission	141	or 70 per cent.
Guillotined legs: Healed	7	
Unhealed	31	
Guillotined thighs: Healed	22	
Unhealed	69	
Guillotined arms: Healed	20	
Unhealed	25	
Guillotined forearms: Healed	9	
Unhealed	13	
Guillotined feet: Healed	0	
Unhealed	3	

The operations required have been reamputations, plastics on the soft tissues, excision of bone spurs and sequestrectomies. The percentage of tender stumps due to neuromata has been very small, 2 tender bulbous nerve ends. Reamputation is indicated in all where sound healing will not take place over the protruding bone, in healed cases with large poorly nourished scars over prominent bone ends and when the site of the former amputation is undesirable for fitting. Plastic operations are done for deep adherent irregular scars that are tender, prone to ulcerate or produce an eczematous condition of the surrounding skin. At times it is difficult to determine whether reamputation or a plastic is necessary. Trial fittings aid

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(6) Annals of Surg., May, 1919.

in making a decision for or against operation. It has been learned by experience that a poor appearing stump often makes a good functional one. Sequestra are not infrequent. The end of the sectioned bone becomes entirely separated in the shape of an irregular ring which is usually imbedded in or completely surrounded by an involucrum. The frequency of ring sequestra may be partially due to the denuding of the end of the bone of periosteum. the aperiosteal method of Bunge.

The time of secondary operation on guillotined or infected stumps cannot be too carefully considered. To recognize this time is the deciding point between success and failure. It would be ideal to wait 3 to 6 months after sound healing before operation, but this is hardly practicable for returned soldiers in a military hospital. And it has been found this long wait is not necessary for success. Early reamputation has been recommended by some writers, but Orr is convinced Huggins is correct; that there should be no edema present when secondary operation is attempted. By "edema" not alone is meant the ordinary swelling that pits on pressure, but also the deep firm induration around the end of the bone. When this condition exists there is certain to be more or less active infection harbored in the deep scar tissue, bone granulations and lymph spaces. When the edema and induration have completely disappeared the stump may be operated upon with success regardless of unhealed areas.

The method of simply making a circular amputation of an extremity, dividing the skin, muscle and bone, at the same level, *is a resurrection*, and what J. H. Gibbon[7] has seen after these amputations, the frequent secondary hemorrhages, the slow healing extending over months, the painful dressings and the secondary operations which are necessary in nearly all, cause him to designate the resurrection as unfortunate. His first sight of these stumps was in great numbers at a British base hospital, where they were obliged to operate often for secondary hemorrhage, usually from the femoral. Repeated hemorrhages occurred in a number of thigh amputations necessitating ligation of the common femo-

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(7) Annals of Surg., July, 1919.

ral in many instances. In spite of the constant irrigation with solutions, the adherence of the gauze to the raw surfaces, and especially to the exposed nerves, made the dressing for a number of weeks an extremely painful procedure. All kinds of devices were used to prevent this sticking of the dressings and thus lessen the pain, but none was very successful until the surface had become well covered with granulation tissue. The application of appliances to draw down the skin, which had already in most instances become fixed at the edges, was itself a painful and troublesome procedure and too often did not succeed sufficiently to obviate a secondary amputation or a plastic operation.

Because of these dangers and difficulties, there must have been some very strong reasons to justify this amputation. The justification seemed to rest on 2 reasons: it was life saving, because quickly done, especially in gas gangrene, which was the common cause of amputation, and it gave a good stump for an artificial limb. For these reasons this method became quite universal in France, and yet Gibbon does not think either or both justified the practice because of the complications already enumerated, and he did and saw enough amputations later where a skin flap was made and reflected to an extent that fully exposed the divided muscles, and where healing was fairly prompt and a good conical stump formed, to prove the guillotine amputation had no place, or a very limited place, in war surgery. It may be said that the reflected flap method does not obviate the painful dressings and the secondary hemorrhages; but this is not true, for in every instance where prompt evacuation or death did not occur, the wound had become sufficiently clean in 4 to 10 days to permit the bringing down of the flaps, and he can recall no case of secondary hemorrhage after the sterilization of the stump and the approximation of the flaps. The hemorrhages seen in the cases of guillotine amputation occurred after the 10th day. The making and the reflection of the flaps occupies but a few min. and cannot greatly increase the shock. A circular suture passed around the ligated stump of the vessels buries it sufficiently to insure against early hemorrhage. If the flaps are properly reflected, the wound is as wide open as in the guillotine amputation. Finally the reflected flap method gives exactly the same type of stump, but earlier, with less suffering and less danger.

Kineplastic Amputations. M. Fitzmaurice-Kelly[8] describes the methods and results in *a series of 13 cases.* The forms of plastic motors attempted have been 2: club-shaped, built up of muscles with their bony insertion, or an adventitious bony attachment, and loop motors, by constructing a canal or tunnel lined with skin and surrounded with muscle or tendons. Of the 13 cases operated on, in 4 club-shaped motors alone have been made (two each in 3 cases and three in the fourth); in 3 cases skin tunnels only have been constructed (one in each case), while in the remaining 6 cases, two club-shaped motors and one tunnel have been made in each case.

The tunnelisation and club motors have been combined in 6 cases. First, a skin tunnel was made in front of arm, just above the bend of elbow. The biceps tendon was split after being divided low in the wound, and the superficial half brought in front of the tunnel and sutured to the deep part. Then motors of the club type were made of the triceps and brachialis anticus, the plastic operation to cover the canal being left to the end, when it was made easy by taking up the slack skin from the end of the stump. The object is to use the biceps as a supinator of the artificial hand, but none of the cases are sufficiently advanced yet for a definite opinion to be expressed as to whether the motor will develop sufficient power or independence of action to be effective, and in the most recent case he made a third club motor by turning up a U-shaped flap from the front of elbow, detaching the tubercle of radius and shortening the biceps tendon by folding it in a Z upon itself.

Kelly is not favorably impressed with the possibilities of the skin tunnels. Others who have used the method—notably German surgeons, using a technic similar to Rochet's urethroplasty—have had trouble from excoriation of the canals, and though this risk is di-

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(8) Lancet, Aug. 16, 1919.

minished by making short wide tunnels with a good blood- and nerve-supply, it still exists. More important is their limited range and power, as compared with the club motors, and they will probably not take a permanent place in kineplastic surgery.

On the other hand, there seems good reason to hope much from the club motors, especially when multiple, and including a pair of antagonistic action. The motor being wholly exteriorised, the covering remains healthy and able to bear pressure, and about the power developed there is, happily, no doubt. That is, after all, as one would have guessed, as the preservation of the bony insertion of a muscle means the concentration of the force it exerts in one available point. And, as far as tested, they bear pressure well, even within a few weeks of the operation. One of the early cases is now on a temporary training apparatus made out of a Thomas arm-splint, working the muscles against an elastic resistance, and, tested with a steelyard inserted in place of the indiarubber tubing, he registered 15 lb. with one motor and 21 lb. with the other at the first attempt. The arm still appears quite wasted, and is capable of much greater development. And several of the later cases are much more promising—the motors have been made longer, and it is proposed in some of the early cases, to remove an inch more of the humerus to increase the range of the motors.

The apparatus used to attach the motors is a metal collar with hinge and screw adjustment, similar to Putti's. They are coated with vulcanite. They should not fit accurately, as if they do marked congestion of the motor is caused, and are now made circular for motors which are oval in section, and vice versa. The motor then keeps its color perfectly, and the patient is more comfortable.

All the cases in the series are arm amputations, but though the much more satisfactory prostheses available make the problem less urgent in the lower limb, Kelly thinks there are certain cases in which it is worth while. *I. e.*, the group of short and unsatisfactory stumps below the knee. Some of these, owing to deficient movement, cannot be fitted with a limb; others with very short stumps, after trying a kneeling leg and finding it unsatisfactory, return for re-amputation above the knee. In some of these cases, it is proposed to build motors of the quadriceps and hamstrings, so as to give voluntary control of the knee-joint. It should be easier to do, and to fit, than the operations near the elbow.

Vanghetti's operation has been modified by W. F. Brook.[9] One author finds fault with Sauerbruch's method providing the loop motor, for this is all tunnelization amounts to, on the score of "difficulties in maintaining the nutrition of the long flap (in which the lines of blood and nerve supply are largely cut across) and in bringing together the edges of the gap caused by its removal without dangerous tension and inconvenient traction upon neighboring parts." For 8 or 9 months Brook, when occasion arose, made use of Sauerbruch's method with more or less success, getting over the above difficulties by—1. Cutting the flap in the long axis of the limb of ample width (*i. e.*, not less than one-third of its length) and with a good lining of subcutaneous tissue. 2. Avoidance of pressure on the skin tube by leaving in it at the time of operation nothing larger than a probe, and by making the muscle canal of ample capacity. 3. Leaving a layer of subcutaneous tissue on the raw surfaces from which the flap is lifted, and covering in with a Thiersch's graft instead of drawing the edges together.

Even so, however, the range of movement is poor owing to another and fundamental defect which underlies the whole method. The tissues tunnelized are not only muscle and skin, but fascial sheaths of muscle as well. The continued traction of the working muscle will very soon mobilize skin if free from scar tissue, but on the other hand, fixation of the skin tube to fascial sheath will more or less effectively anchor it and largely defeat the object of the operation. Still, tunnelization of muscles with a skin tube is likely at times to prove useful in Vanghetti's operation.

Brook had occasion to amputate above the elbow, and was fortunately able to save the whole of the biceps and an ample anterior flap of skin. The musculo-

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(9) British Med. Jour., Dec. 7, 1918.

tendinous stump of the biceps was isolated and tunneled ½ in. from its end (diagram). The anterior flap was split vertically at about the junction of its outer and middle thirds and the outer portion, fashioned into a tube, was drawn through the tunnel in the biceps and fixed in a small skin incision, as at *D*. Though primary union has occurred in the skin tube in spite of a septic focus at the back of the stump, it is too soon to speak with certainty, but it is hoped to combine the large range of movement of Vanghetti's peg motor with the advantage of his loop.

A note on reamputation is furnished by A. E. Chisholm.[2] Some of the reasons calling for this are: Adherent scar with weak or partial healing; a chronic granulating surface, especially if terminal and near the end of bone; presence of sinuses; sequestra. A tourniquet is rarely necessary. If the main vessel be properly controlled by digital pressure, very little blood should be lost. The main vessels should be cut through late and clamped early. It is well to superimpose the fingers of the two hands in controlling the femoral, so alternate relief may be given without changing position. In thigh amputations without tourniquet slight bleeding may occur from the terminals of obturator and sciatic, but can be quickly clamped. In operating below knee pressure on the femoral in groin, if properly applied, should satisfactorily control bleeding. It is more difficult to find the main vessels in this region than in the thigh, because of their proximity to the

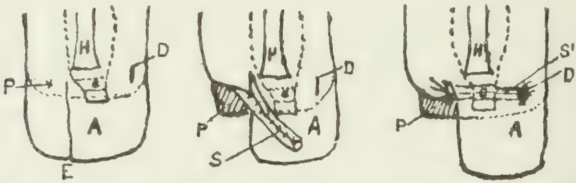

Fig. 25. Diagram showing tunnelization of biceps in face of stump during amputation; biceps tunnelled at *C*. *H*, Humerus; *A*, anterior flap split at *E* and punctured at *D*; *P*, posterior flap; *S*, skin tube fashioned; *S′*, ditto *in situ* (Brook).

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(2) British Med. Jour., July 19, 1919.

bones and the tendency to retract, but the difficulty is not great. In the upper limb there should be no difficulty in obtaining a good purchase over the brachial digitally. It is common to find a good deal of firm fibrous tissue extending for some distance up the line of the greater vessels. No digital pressure may be required at all, but it is wise for someone to be ready in case of need.

The following points are of practical value in re-amputating: 1. Avoid a terminal scar. It is usually easy in thigh, but otherwise in leg, if amputation has previously been performed fairly high up. Sometimes, owing to lack of skin, it is not possible to avoid a terminal scar and yet retain enough bone for the fitting of artificial limb. The scar must take its chance, so as to preserve the joint, in such a case. But troublesome adherence may be avoided by guarding against infection, and also, possibly, by including a thin layer of muscle in the flaps; a retention suture left in for a few days will tend to prevent the scar from adhering in the wrong way to the bone; the suture should be guarded with tubing to prevent it cutting into skin. 2. It is rarely necessary, and probably rarely wise, to include muscle in flaps. A good fibrous pad is formed between the skin with its integuments and the end of bone. 3. Re-amputate clear of the disability for which re-amputation is being performed, and try to make sure no further operation will be necessary. The object is to get a good sound serviceable stump. It is far better to sacrifice a little extra bone, than to risk yet another re-amputation some weeks or months later. Therefore the flaps should be cut clear of the scar unless there is some real reason against this. The scar especially should be avoided if there is the slightest suspicion of sepsis. According to Huggins, the evidence a stump is ready for re-amputation is the disappearance of edema from the skin and deep structures. It may be necessary to cut through and often include in the flaps the deeper scar tissue and sometimes lateral scars, but the scar in relation to the end of the bone should be avoided.

4. In dealing with terminal sequestra a difference must be made between those cases with little or no ac-

tive sepsis and those in which sepsis is pronounced. 5. Re-amputation should not be performed in presence of a really actively septic wound. Healthy granulation is not a contraindication, but a really septic granulation surface should be considered a danger signal. 6. If the wound fills up with clot—*e. g.*, after a reactionary hemorrhage—it is well to open it right up under anesthetic, clear out the clot, re-suture, and drain in usual way. Otherwise there will be great risk of a septic state. 7. If skin is scanty, and if it is important to preserve the length of the stump with a view to future function and fitting, extension may be applied by glue or strapping from the stump to some form of wire splint. This may be in use for days or even weeks, prior to operation, and a considerable gain achieved.

8. In amputation a short distance below the knee it is well to apply a posterior splint before coming out of anesthetic, for there is a great tendency for the knee to assume the flexed attitude of rest, and, if convalescence be delayed, a certain amount of contracture of the hamstrings, often difficult to overcome, may take place. 9. If sepsis appears in a mild form after operation, fomentations or Carrel's treatment may be applied for a few days. 10. If re-amputation has to be performed in presence of a sinus only very mildy septic, or if the muscles do not look very healthy, a flavine pack will be found of value, the wound being left open with a view to delayed primary or secondary suture later. Or bipp may be applied, suturing the wound and providing drainage for serous oozing for a few days. 11. In amputations below the knee the ant. edge of tibia should be bevelled to prevent the sharp edge from pressing on the anterior flap. It is important also to divide the fibula about ¼ in. higher up than the tibia, otherwise fitting of the artificial limb will be interfered with. According to Huggins it is important to preserve the interosseous membrane so as to prevent outward displacement of fibula. 12. Chisholm's usual routine, before suture, has been to swab the raw surface with ether, which, besides acting as an antiseptic, tends to encourage bleeding, so small vessels which might lead to troublesome bleeding later on can be ligated at the

time. Ether tends also to show up unhealthy muscle by the fact it may not react so well to the stimulus. This especially applies to avascularized damaged muscle seen soon after the primary wound. The wound is then closed and sutured accurately. A narrow rubber dam is introduced at each end of the wound. These drains are left in 2 or 3 days and then removed provided no sign of infection has appeared.

In this series of cases the average time of operating since the last amputation has been about 6 months, ranging from 2 to 13. No doubt time is an important factor from the point of view of latent sepsis, but the clinical condition of the stump is of even more importance. It cannot by any means be claimed that all wounds heal up by first intention. But if these rules are adhered to there will be few, if any, failures.

W. A. Chapple[3] makes a report on *temporary pegs for leg amputations*. It has been agreed that during the interval between the healing of an amputation stump of the lower limb and the provision of a permanent artificial limb, a man should wear some temporary peg. The period of more or less rapid shrinking and reshaping of the stump follows healing. Though the stump may appear to be following a normal course, however, the scar may become tender, or break down and ulcerate, or bulbous nerves may form, or spurs may develop; devitalized bone may, instead of recovering, necrose, or the atrophy and shrinking of the soft tissues may be so complete as to bring to the surface bony spurs or prominences that make the stump rebellious to a mechanical appliance.

An ideal stump is one which most nearly conforms to Nature's stump, the normal heel, and is capable of bearing without discomfort the whole weight in normal locomotion. The normal heel is dome-shaped, covered with skin capable of hardening with use, free from scar, and has a subcutaneous pad of fat honeycombed with connective tissue, which lies upon the periosteum covering the bone. Every surgeon aims at reproducing these conditions in a stump.

A well fitting boot suggests the characteristics of an

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(3) British Med. Jour., Nov. 30, 1918.

ideal bucket. An ideal bucket will therefore have a smooth shiny inside surface, with a diaphragm so placed as to carry a maximum portion of the weight on the end of stump, and a rim so contrived and shaped as to carry the remaining portion of the weight by coaptation to the appropriate bony surfaces, near the joint.

Various kinds of temporary pegs have been designed. A peg can be used even before the stump is quite healed. It rapidly shrinks and shapes the stump to its permanent size and form. It trains at the soonest possible moment the muscles that are to move the stump in locomotion. It tends to prevent stiffness from disuse of the adjacent joint. It picks out the weak spot in scar or bone or nerve that is destined to give way later to the pressure of the permanent limb; and it does this without waste of time, and with the scrapping of a limb that cost under $2.50 instead of one that costs $75 or of a bucket that costs $20. It avoids the danger of crutch paralysis; the displacement of the centre of gravity of the body, and the unequal distribution of pressure on the joints of sound limb. It frees the hands from the immobilization that crutches entail, and permits the man to get on with work or training. It supplies him with a spare for use if his permanent limb breaks or has to be repaired.

The ideal peg has not yet been found. They may be divided into: (1) Therapeutic, and (2) Auxiliary pegs. The therapeutic is one which shapes the stump, but has no durability for permanent use. The auxiliary is serviceable after the limb has approximated its permanent shape. It may be used to fill the interval between shrinking and when a permanent limb can be supplied. If well made and well fitting and of durable material there is no reason why it should not act permanently as a spare, a rest, and a "slipper." The most generally used therapeutic peg is the plaster pylon made of 2 wooden struts morticed into a turned wooden ferrule, on bottom of which is a rubber heel. These uprights are of unequal length for a thigh and of equal length for a leg stump. After the skin is smeared with vaseline, the upper ends of struts are embraced in plaster bandages, which are wound round the stump.

When a sufficient number of turns give stability, it is left to harden, then slipped off and reinforced with more bandages, the edges being turned over and shaped to conform to the bony prominences. The inside is made perfectly smooth with plaster cream. It is usually hard within 48 hours and is ready for use. A hook is advisable in the outer strut for a thigh stump, and also a wooden spreader between the struts that braces may be attached and used to support the weight of the peg. The only lining needed is one or more socks.

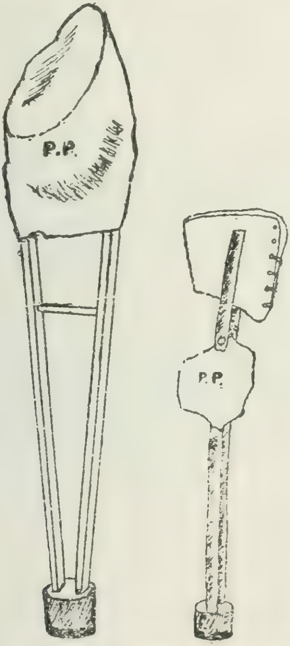

Fig. 26. Plaster pylons; *PP*, plaster-of-paris bandages (Chapple).

[In constructing the plaster-of-paris bucket for the upper end of this temporary peg, a marked advantage is gained by applying the first layers of plaster bandages longitudinally so that they cross each other at the end of the stump. By rubbing these carefully a beautifully-fitting bucket can be formed, containing about three layers of bandages, except at the lower end where the bandages cross each other. One bandage overlapping about one-third of the width of each bandage will hold the longitudinal bandages in place. This bucket is permitted to harden for 24 hours, when it is covered with moist plaster; and the peg is adjusted and fixed in place by circular plaster-of-paris-bandages.—Ed.]

The auxiliary pegs are more permanent. Plaster-of-paris soon crumbles, and the peg is valueless in 6 to 12 weeks, but can easily be remade by chipping the plaster off the struts and reapplying bandages. Auxiliary pegs are described made of papier-maché, laths, fibre and leather or leather-board. They are cheap and if shrinkage occurs, either the bucket or the whole peg can be remade.

Painful Stumps. The *relation of infective scar tissue to pains*, is dwelt on by E. M. Corner.[4] All the structures which have been divided, as in amputation, take part in the healing of the wound. Thus normally and naturally there is a reparative osteomyelitis, osteitis, periostitis, myositis, neuritis, arteritis, phlebitis, lymphangitis, &c., and their attendant external and surrounding inflammations like perineuritis. The perineuritis is really a lymphangitis, and, clinically, there is a most important practical observation to be made; the peri-inflammation—*e. g.*, perineuritis—extends outside higher up the structure, a nerve trunk, than the concurrent internal endoneuritis. This enables the surgeon to see that a nerve is divided above its internal inflammation.

Beneath the sawn end of the divided bone there is a dead space, which becomes filled up with scar tissue, which takes its character from that of the healing of the wound. At times it is filled with noninfective scar tissue, as when the wound heals well; and at others the scar tissue is irritative and infective from the micro-organisms imprisoned in its meshes. Marinesco and Corner showed some organisms grown from the nerve-endings in a wound which had been healed for 3 years. Hence the local cause for painful nerves is to be found

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(4) Lancet, May 17, 1919.

in a terminal infective neuritis and not in any "bulbosity." A bulbous nerve results from every division of a nerve trunk. But if the ends of the nerves are inflamed the bigger and the more tender the nerve bulb.

The healing of the wound apparently by first intention does not exclude the possible presence of harmful organisms in the tissues of the deeper part. A sharp line is to be drawn between the external scar in the skin and the internal scar under the bone. The condition of the former is an uncertain guide to that of the latter. It would appear the changes in the behavior of the phantom limb are a better guide. Previous to this inflammatory theory of the origin of the pains of wounds and amputation stumps, the pains were always regarded as due to nerve adhesions and strangulation by cicatrices. From an examination of painless stumps it is plain such conditions are frequent in them and that they themselves produce little or no pain provided the nerve-end is not inflamed. Hence it is possible for the pathologist to decide by the presence or the absence of signs of inflammation if any given specimen shows evidences of the peripheral or central (neurotic) origin of the pain. At least 9 out of 10 complaints are purely central.

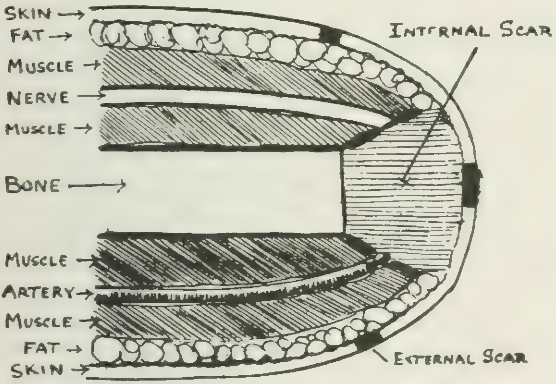

Fig. 27. Locations of external and internal scars (Corner).

Silk and other unabsorbable material, such as iron, is slowly fragmentated and removed when situated in infective scar tissue. They are not isolated by encapsulation as in ordinary non-infective scar tissue. Thus all foreign bodies are best removed and their tracks drained. The body only slowly sterilises infective scar tissue. Silk ligatures are apt to become, if infected, centres of irritation.

By reparative myositis the muscles attach themselves to the internal scar which in its turn is attached to the bone. This is the normal reattachment of muscles to the end of the stump.

Among channels for disseminating the irritation of infection the vascular lymphatics come first. They carry the infection furthest and widest. The lecturer showed a triangular plug of scar tissue in the popliteal space causing an intractably flexed knee. In this irritant scar tissue is to be found the key to the flexion of joints.

Corner, in a later paper,[5] takes up *nerves in amputation stumps.* The immediate pain consequent on an amputation is due to the injuries inflicted on the nerves at that operation. It passes away in a few days. The early pain after an amputation is due to the ends of the nerves, if not cut short, taking part in the general repair of the wound. If the repair is infective there is an infective neuritis. If precautions are taken to cut the nerves short and close their open mouths in a simple way, as by the swing-door method, the interior of the nerves are not infected from the wounds.

The practical points arising from this are: 1. Cut short the divided nerves. 2. Close the mouths of divided nerves. 3. Avoid all wound infection, such as by avoiding handling and manipulation, which are the great causes of low-grade infections such as are not necessarily suppurative.

The healing of a wound by first intention in clinical work does not preclude the presence within it of low-grade infection. Nerve anastomoses mean much manipulation and are therefore banned. The swing-door method is the best and simplest. Nothing is left behind in the wound which has been touched.

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(5) British Med. Jour., May 24. 1919.

The causation of remote pain is more complex. Three factors are now known: 1. Infective inflammation and its results, islands of fibrous tissue, within the nerve. 2. The presence of foreign bodies, much insisted upon by Marinesco. This includes metal, silk, and, if the words "foreign bodies" are given a large sense, all material such as fibrous tissue in the interior of a nerve ending. 3. The mental factor, due largely to illness, prolonged hospital stay, lost jobs, inability to take up new ways and interests, etc. It is a very large factor.

There may be still more factors, *e. g.*, that due to vessels trying to expand or contract in tissues permeated by fibrous tissue, but at present their clinical importance is unknown. Three items of practical value stand out in this: 1. Do not use silk in infective wounds. 2. Do not keep men herded together in homes and hospitals longer than necessary. 3. Get them back to some kind of work, which will absorb their attention and take it off their condition, as soon as possible.

An example of a *false neuroma in a stump* is recorded by F. Warner.[6] A man, of 63, had the leg amputated in 1884 due to an accident. In 1904 a bulbar enlargement on the end of a nerve in the stump was removed. How long this enlargement had been present he does not know, but the stump had been painful for a long time, and reflex twitchings had been present along with the painful condition of the stump. The operation relieved the condition in part only.

In June, 1918, the patient consulted Warner on account of the painful condition and the general muscular twitching of the muscles in the stump, which was especially aggravated at night. This condition had existed for years, but had been especially increased during a few months preceding the consultation. An examination revealed a well-defined tumor in the line of the tibial nerve. The mass was not especially sensitive, but deep and firm pressure produced pain. An operation for its removal was accepted. The tumor, 1½ in. long by ¾ inch in its lateral diameter, was found to be a terminal enlargement of the severed tibial nerve. The operation has been followed by a complete relief of the symptoms. Whether this is permanent remains to be seen.

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(6) Interstate Med. Jour., February, 1919.

WOUND HEALING AND PATHOLOGIC INTERVENTION.

Malaria. In a consideration of *malaria from the surgeon's standpoint*, M. White[7] states the only type to be taken into account is the subtertian or malignant tertian. In the quartan type the *Plasmodium* goes through the entire process of reproduction in the blood, and does not especially accumulate in any one organ or produce special effects. The tertian type, produced by the *Plasmodium vivax*, also goes through its life-cycle in the blood, and although the tertian sporulating forms are found in the internal organs, such as the spleen, they do not tend to accumulate or produce special effects. The third type, the subtertian or malignant tertian, caused by the æstivo-autumnal parasite, sporulates almost entirely in the internal organs, attacking any organ and producing symptoms peculiar to the disease of that organ.

In 2½ years in Malta the cases seen in which malaria has proved to be the direct cause of surgical ailments referable to one organ have been comparatively small and with a very small mortality. Malaria as a complication in surgical cases and malaria simulating certain diseases are far more common, especially the first, where all the symptoms may indicate some other illness, *e. g.*, after a gunshot wound of the head (and this is frequent) the symptoms may all point to a cerebral abscess, but under quinin the urgent symptoms disappear and recovery is uninterrupted.

It is practically always the condition of latent malaria in patients which is the most annoying, though rarely fatal, complication in surgical cases. These patients give no history of having had malaria, and usually a history of perfect health up to the time they were wounded. The surgeon operates quite confident that everything will be all right, then 24 to 48 hours after operation an impending attack of malaria is often foreshadowed by these symptoms, noticed especially in bone and joint cases. The patient complains of severe pain in the wound; the latter looks unhealthy; joints often

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(7) Lancet, July 26, 1919.

become very swollen and exquisitely painful, the least movement causing much pain. The temperature at this time is subnormal, but in a few hours rises to 105° or 106°, without a rigor. If seen at this stage, give immediately quinin gr. 15, intramuscularly. White had a number of these cases under her care, and found the impending attack cannot be prevented by giving quinin at this stage, although it may be considerably shortened, and by giving another dose, also intramuscularly, the next day a second attack is rare. Delayed healing is also a feature in this type. Wounds look unhealthy, granulate over, only to break down again in a few days. Some of them resemble syphilitic sores, and often it is only with a negative Wassermann and response to quinin one becomes convinced that malaria is the etiologic factor. She has never seen these conditions in known treated cases of malaria. As a prophylaxis 15 gr. of quinin intramuscularly the night before operation is extremely valuable.

The relation of quinin to hemorrhages is still a debated question. Her own experience tends towards the view that the quinin has very little, if anything, to do with it. The last case recorded was an amputation of the leg. The most interesting thing about this case is that for nearly 2 years under certainly not the most ideal conditions in Salonika the patient had no relapse of malaria in a known subtertian infection. This case proves the parasite may remain dormant for years and the patient in perfect health. Suddenly it may light up when the vitality of the body is lowered and produce an attack of a very serious nature. Also the sudden acute dilatation of the heart in these cases is very common, often proving fatal.

H. Alamartine[8] takes up *paludal gangrene of the limbs.* As far back as 1883, Verneuil and Petit called attention to this affection, but with the decrease in malaria it was forgotten, till the Macedonian campaign revived it. Details of 3 cases, 1 fatal, are given. Clinically they present as massive gangrene of the lower limbs, necessitating exeresis of the involved member. Pathologic anatomy shows they are due to obliterating

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(8) Presse Méd., Aug. 21, 1919.

endarteritis. They show the undoubted effect of the hematozoon is producing this endarteritis with subsequent gangrene, and are directly due to malarial infection by Plasmodia, which, of course, was unknown to Verneuil and Petit.

There seems no doubt as to the direct influence of the malarial organism. In all the cases observed there was intense infection of the blood and viscera by the hematozoa. The hypothesis of associated infection can be easily eliminated. *E. g.*, the Wassermann was negative in all instances, while histologic examination showed nothing similar to the lesions met with in syphilis. The different acute septicemias, such as typhoid, may also be eliminated by the clinical course as well as the lesions found locally or at necropsy.

Paludal gangrene is a grave occurrence and of serious omen. It is often one of the terminal manifestations, as in cases where we see wet gangrene of both feet in a cachectic patient in subcoma. The prognosis is much better in unilateral gangrene appearing early in chronic paludism but without the usual symptoms of grave malaria. The same where the manifestations have the clinical aspect of Raynaud's disease. (These latter patients rarely come to the surgeon, at least in the beginning.) In this form the specific treatment by quinin seems to have a powerful action on the lesions from local asphyxia, even the small gangrenous patches. Such subjects are medical cases, and all the surgeon has to do is to insure aseptic dressings, and exceptionally later on to do a very limited trimming up.

In the massive type, on the contrary, we come to a surgical affection. Quinin in large doses has no effect, either in the dry or the moist type, and there is no need of wasting time by its use. But the indication for operation is more or less urgent varying with the clinical type. In dry gangrene one should delay operation as much as possible to lessen the amount of tissue to be sacrificed. The therapeutic conduct will not differ from that customary nowadays for dry gangrene due to other causes. In the forms with rapid development, on the other hand, Alamartine believes surgical exeresis should be speedy. From the beginning there is a massive intoxication which calls for rapid sacrifice of the limb. Early amputation gave him a good result in a case which seemed extremely grave. The fatal case was no doubt due to amputation being done too late. He knows of several deaths because patients refused amputation. Naturally the operation should be done by as simple and rapid method as possible, and primary suture should not be made, in favorable cases there is time to wait for secondary closure. The amputation should be preceded and followed by an intensive treatment with quinin.

Influenza and Surgery. J. L. Faure[9] starts his discussion of this topic by remarking that for many years the profession has been under the belief that direct infection alone had any influence on operations; no account was take of the season of year, climate, etc. Only the operating room, the sterilizers, sterilizing the water, dressings, gloves—in short all articles which might come in contact with the patient occupied and preoccupied the surgeons' minds. A few it is true, endeavored to sterilize the air of the operating rooms, to be sure the old spray had disappeared, but they installed ventilating apparatus, filters for the air, they combatted dust by sprinkling, but such surgeons are still in a small minority. Most of them confident that aerial infection was of no moment, neglected it.

Faure, however, for years as the result of prolonged experience and observation, cultures from the air and the dust of operating rooms, and intensive study of accidents impossible of explanation by the common causes of infection, has been firmly convinced that contagion—or rather infection—by the air exists. He had the dust laid regularly by sprinkling and every 8 days the room was washed with formalin. In truth, this cause of infection is exceptional. The genuine causes of infection are well known, now that the aseptic education of all surgeons, their assistants, and of the whole hospital personnel is perfect, so to speak. When the operator and his assistants have examined their conscience, if the water is found sterile, if the sterilizers act well, we must look for the cause elsewhere—in the

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(9) Presse Méd., July 24, 1919.

air. All of a sudden in January, and the first half of February, 1919, in the midst of the most perfect aseptic measures, infections appeared. The water was tested and the cultures were sterile, the sterilizers were in perfect condition, the assistants had not been changed, yet two patients succumbed after operations for carcinoma of the cervix. At first Faure paid little attention to this, since the Wertheim operation so often ends fatally. Then several other patients died unexpectedly, one after a fibroma operation with a temperature of 107.6° F. Then these strange deaths, the first in a long series of successes, stopped suddenly on Feb. 15, and have not recurred. Many patients, suddenly developed embolism; two on the same day, one fatal. In another series, also operated on by him, Faure saw 5 cases of embolism from Feb. 15 to March 30, two of these were mortal and one very serious, yet formerly a year or more might elapse without him meeting a single example. During the same period, other patients developed phlebitis, after operations where this is never heard of, *e. g.*, appendectomy or amputations of mamma for carcinoma. The epidemic of influenza (November, 1918, to March, 1919) was more violent during two short periods, and the accidents referred to were in the second, for in the first (October-November) nothing particular was noted.

At the time mentioned with thousands and thousands of persons simultaneously attacked, the community lived in an atmosphere of poisoned dust, clouds of virulent microbes. It is not strange then, that after divers operations, the most unexpected and virulent infections followed either by the blood current or by direct infection of the peritoneum in laparotomies. Faure was struck particularly with the frequent examples of embolism, many other cases of which occurred in cases cared for by colleagues. It is probable that the wide-spread infection caused changes in the blood favorable to coagulation and made evident either by thrombosis followed by embolism, or by sudden embolism. From Feb. 15 to March 30, he saw 7 cases! None had been met with for a long time previous, nor since then.

The maximum of the second invasion of influenza in Paris was in the week of Feb. 16-23. Of the patients operated on from Feb. 12-24, he had 3 deaths from septicemia, and 4 cases of embolism, 2 fatal, besides a case of bronchopneumonia. In March, the accidents lessened singularly, 3 cases of embolism, one fatal, 2 of phlebitis, 3 bronchopneumonia, one mortal. After March things resumed their normal course. In conclusion, Faure advises that during these terrible visitations of influenza, no operation of importance should be done till the disease has abated.

During the 1918 epidemic of influenza, in addition to the empyemas (see Chest), F. M. Manson[1] states the following *surgical complications* arose: 14 cases of mastoiditis; 105 of otitis media; 1 of frontal sinusitis; 4 of purulent peritonitis; 2 of appendicitis (ruptured); 4 of multiple abscess; 1 of phlegmon of neck; 1 of chest; 1 of ileus (mechanical); 1 of edema of glottis.

Postoperative Pneumonia. The cases at the Presbyterian Hospital (N. Y.) *during 1917*, are analyzed by M. Cleveland.[2] He believes it advisable to divide quite arbitrarily, postoperative pneumonitis into at least 3 types. 1. The true postoperative (often called ether) pneumonia: within the first few days after operation, with cough, rise in temperature, usually due to some exposure. 2. Embolic pneumonia, at any time after operation and as far as is known, one of the accidents of the postoperative course. 3. Terminal pneumonia, usually in patients *in extremis* after a short or protracted postoperative course.

There were 1,940 operations, and 65 pneumonias (3.3%); 7 embolic, 58 postoperative. While the embolic pneumonias were nearly evenly divided between men and women, the postoperative were present in men 4 times as frequently as in the women. It may possibly be due to the fact that women are less exposed to coughs and colds than men and the oropharynx is not so chronically inflamed. The influence of the season is seen when 65 per cent. occurred during the winter and spring months. No explanation for the relatively large number in August can be advanced unless it was due to a

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(1) Amer. Jour. Med. Sci., August, 1919.

(2) Surg., Gynecol. and Obstet., March, 1919.

general relaxation of prophylactic vigilance toward the end of the summer. The embolic pneumonias were widely distributed, no two within the same month. Fifty-two per cent. of the cases of postoperative and embolic pneumonia occurred in the third and fourth decades. Only 4 patients were over 60.

Among the predisposing factors are the following: (A) coughs, colds, etc., previous to admission or exposure while in hospital; (B) condition of the patient; (C) type of operation; (D) anesthesia. *A.* Some 54 patients gave such history. *B.* Roughly speaking, the patients were in good physical condition. *C.* Of the operations 86% were celiotomies, and most of these relatively simple, 19 hernias, 16 appendectomies, etc. *D.* That the anesthetic *per se* does not cause the pneumonia is no longer doubted. The irritation does, however, prepare the way for organisms already present.

Gas-ether sequence, closed method	44
Gas-oxygen-ether	7
Ether, drop method	7
Ether-intrapharyngeal	3
Gas-oxygen	2
Chloroform	2

The cases were divided among the various anesthetists, professional and members of the house staff about in proportion to the number of anesthetics given by each. The length of anesthesia had very little, if any, influence. The shortest was 3 and the longest 140 min., with an average of 62.

There were 7 deaths. No one of these occurred where the pneumonia was the only complication; *i. e.*, no otherwise healthy patient undergoing operation died as a result of his pneumonia. Malignancy claimed 3, all in very poor condition. A pulmonary embolus caused one death. Another patient died in a diabetic coma following drainage of an alveolar abscess. A mastectomy in a patient of 65, not in very good condition, resulted in a fatal pneumonia. The 7th died of inanition following a duodenal fistula rather than from pneumonia.

The following prophylactic measures have been instituted: 1. Great care is taken to elicit a history of recent cold, cough, sore throat, etc., and in the physical examination the respiratory tract is given special attention. Patients with history of recent cough or signs of rhinitis, tonsillitis, pharyngitis, etc., are sent home to wait a week or two if their operation be one of choice. 2. In operations of necessity in patients with signs of inflammation of the respiratory tract, ether is seldom used, if it can be avoided. Chloroform, gas and oxygen, and local anesthesia have been used whenever possible.

The following measures for prophylaxis were put in the form of rules for the nurses: 1. The temperature of the bathroom for the routine admission bath must be 70° F. 2. No patient who has had his admission bath and is to be operated on the following day shall be allowed out of bed. 3. The hair of all female patients is to be thoroughly dried with an electric blower. 4. Before leaving operating room each patient shall be given a dry, warm night shirt and be carefully covered with sufficient blankets. 5. On arriving in the ward, a cotton pneumonia jacket shall be put on each patient. 6. Sufficient blankets must be provided and all draughts avoided. 7. As soon as patient is conscious, a heavy woolen bed jacket is to be worn. (The rules relating to blankets, bed jackets, etc., did not apply during hot weather.)

Two additional experiments in prophylaxis were tried: 1. All the patients of one male ward were given tr. of digitalis, 15 minims on admission and every four hours until they had 40 minims in an attempt to obtain a digitalis effect on the heart to combat pulmonary congestion during the operation. 2. All patients of another male ward had their chests rubbed with a turpentine camphor liniment immediately after operation. Of these measures the counter irritation seemed to be of some benefit and came into pretty general use where any respiratory trouble was anticipated after operation.

The treatment is almost entirely symptomatic. If due to pneumococcus group I, serum is to be used. Fresh air by an open window and forced fluids were almost invariably used. Digitalis was used in 38 cases out of the 65, usually in the form of the tincture, though occasionally digipuratum or digalin was given intravenously. On rare occasions camphor or caffein was given, but was of doubtful benefit.

Anthrax. Of *4 cases* treated by Amory and Rappaport[3] all recovered. The source of infection was not definitely determined. In 2, cultures of toilet articles, especially shaving brushes, were made, with no growth. The others were destroyed. All the patients wore chin-straps of leather. One had used his haversack as a pillow. Another used a leather seat as a bed. None had been around animals of any kind.

C. G. Dennett[4] treated *3 more* within a fortnight, with 1 death. Cultures were made of the shaving brushes used by all patients, and only that of Case 1 was positive. This, however, was of little significance, as it had been used after appearance of the lesion.

The *third case in 4 months* at an army camp is placed on record by Norton and Kohman.[5] (The first 2 were narrated by Schultz—1919 volume, p. 178.) It was fatal, and bacilli were isolated from a shaving brush recently purchased. Necropsy disclosed the mesenteric nodes enlarged and intensely hemorrhagic. There were 5 places in the ileum and 2 in the desc. colon which were red and edematous in appearance and approximately 2.4 in. in diameter. Viewed from the mucosa these presented dilated vessels, at times accompanied by hemorrhage in stellate arrangement, the center of which was gray and nodular, the whole underlying the mucosa, except in one place the central nodule was ulcerated. Smears from these nodules showed many bacilli.

According to the *Journal A. M. A.*,[6] the widow of a patient who contracted anthrax from a shaving brush, was awarded $6,500 damages.

The first cases of *anthrax from an infected shaving brush* occurred in England (1917 volume — p. 140). From a "news item" we learn[7] that 4 more cases have occurred there recently, and bacilli found in 6 of 9 brushes, from Japan.

Wound Diphtheria. Report is made by Hartsell and Morris[8] of *a series of 60 cases* at an army hospital. In none of these wounds were there any systemic symp-

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(3) Jour. Amer. Med. Assoc., Jan. 25, 1919.
(4) Ibid.
(5) Ibid., April 19, 1919.
(6) April 12, 1919.
(7) Jour. Amer. Med. Ass'n, Dec. 13, 1919.
(8) Ibid., May 10, 1919.

toms referable to diphtheria toxin. Most patients were well in every way and none showed any elevation of temperature other than what might well be explained by a large débrided wound. The appearance of the wounds varied. Twelve per cent. showed a typical gray membrane. About half only a faint grayish discoloration which under ordinary conditions would have passed unnoticed. About 6 per cent. looked absolutely healthy. So far as could be observed, the diphtheria bacilli in the wound had no effect at all on healing. Wounds slow in healing invariably had large number of other organisms present. Wounds that appeared clean progressed in the ordinary way. And 2 were positive up to complete healing. Forty-three patients received the Schick test. Six were positive, about the percentage for all adults.

The resistance to treatment varied greatly. In some diphtheria disappeared with 2 days' intensive treatment, while others were very resistant, three remained positive for 49, 42 and 24 days, respectively.

By far the most efficient treatment has been the use of iodin. Under the most rigid asepsis the wound was cleaned with a 1 per cent. soap solution, ether and alcohol, and then painted with iodin, care being taken to protect the surrounding skin. Under this treatment the average duration of positive cultures was 6 days. Fifteen cases longer than one week. Diphtheria antitoxin, up to four doses of 20,000 units each, was given in 4 cases, but had no effect in ridding the wounds of diphtheria. It was never necessary to give it for its systemic protection. Diphtheria antitoxin as a wet dressing was used in 2, but without effect. Acetic acid, suggested as a specific, was given a thorough trial in 4 cases, but was also of no value. Two wounds cauterized for a few seconds with phenol were reported positive the next day. The Carrel-Dakin method, applied very exactly in 8 cases, was a failure in 6. Two of the cases cleared up within 48 hours, but probably they would have cleared up just as quickly under iodin. In the failures the method was used 2 to 3 weeks each, and these wounds cleared up very promptly after the method had been discontinued and iodin instituted. Dichloramin-T had caused so much skin irritation that its use had been discontinued by order.

The investigations of Fitzgerald and Robertson were referred to in the 1918 volume (p. 146). Their conclusions were challenged by Adami *et al.* (1919, p. 149). In their latest article,[9] they claim *complete confirmation of their opinion* has just been furnished by Janes and Thomas. Who found that "from those cases in which pure cultures were obtained, 6.4 per cent. of open wounds in this hospital show infection with *B. diphtheriæ.*" They may safely infer, therefore, that the conclusions here arrived at entirely substantiate the inferences drawn as a result of their original observations.

Fitzgerald and Robertson would again recommend that both in civil and military hospitals a careful bacteriologic examination be made of all suppurating open wounds They have pointed out that clinically the diagnosis between diphtheroid or other aerobic, and true diphtheric, wound infections cannot be made. It is necessary, if the diagnosis is to be definitely established, that a careful bacteriologic examination be undertaken which will include virulence tests and protection experiments. It may not be feasible to undertake these in every case, especially early in an epidemic outbreak; but the true character of the infecting micro-organism should be definitely determined in at least a few cases at first, and if the outbreak is not almost at once controlled, routine virulence and protection tests made.

Gas Gangrene. Two *new microbes* have been isolated:

I. From a case involving the arm with prompt recovery after excision, J. L. Stoddard[1] obtained one which is named provisionally *B. multifermentans tenalbus.* It seems to differ from the anerobes described, and at a certain stage produces swollen and irregularly staining forms closely resembling the so-called "citrons" usually believed to be characteristic of *B. vibrion septique.* Certain facts suggest the bacillus may be of importance in symbiosis with *B. sporogenes* in producing local muscle

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(9) Jour. Amer. Med. Ass'n, July 12, 1919.

(1) Lancet, Jan. 4, 1919.

infections. It seems most probable the pathogenic importance is slight and of rare occurrence.

II. A case due to a new anerobe *B. tumefaciens* is recounted by W. J. Wilson.[2] A soldier on Sept. 29 received 3 wounds, the fatal one in l. thigh. Oct. 4 on incising the skin the surgeon called attention to the great amount of edematous fluid present. At the operation 50 of Weinberg's serum were injected subcutaneously into the axilla. The 50 c.c. were made up of 20 antiperfringens, 10 antiedematiens, and 20 antivibrion septique serums. Oct. 5th 60 c.c. of the same were given, the dose for antiperfringens being increased to 30. In spite of the surgical and serum treatment the gangrene advanced and man died at 1 A.M. on 6th.

If the flora of the wound had not been carefully studied one would have concluded that the serum employed had completely failed to control the infection. The explanation was neither *B. perfringens*, *B. edematiens*, nor *Vibrion septique* was present in the lesions, but *the B. tumefaciens*. This is an actively motile Gram-positive bacillus. It resembles *V. septique*, but is easier to cultivate and forms spores, especially in carbohydrate media, with the utmost facility. Like the *Vibrion*, it often shows swollen citron forms, long threads, and "granulose" bodies. Wilson compared the characters with those of the various bacteria described in war wounds, and concluded it was a new species. There are resemblances to Aschoff's "Gasedembazillus," but there are at least the following points of difference: (1) *B. tumefaciens* is actively, the "Gasedembazillus" feebly, motile; (2) spores are more readily formed by the *B. tumefaciens* both in the animal body and in culture; (3) the lesions caused by the "Gasedembazillus" are characterized by a clear gelatinous edema. Those produced by the *B. tumefaciens* resemble the *Vibrion* in being hemorrhagic.

At a meeting of the Paris Surgical Society, M. Lapointe[4] narrated an alleged case of *gas gangrene without any wound*. A man, aged 53, was suddenly seized with acute pain in the middle of thigh. The following day there were the usual signs of a commencing ischemic gangrene of foot and leg due to obliteration of the artery. It was decided to wait for the line of demarcation. By another day, however, there was a complete change, the man became restless, face pale, tongue glazed, pulse 120, in addition there was the characteristic odor of gas gangrene, the foot and leg very edematous, turned bronze, phlyctenulæ appeared, and the whole limb crackled up to knee. Immediate amputation through lower third of thigh, recovery under Carrel-Dakin method.

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(2) Lancet, Jan. 4, 1919.

(4) Presse Méd., April 13, 1919.

In the discussion, M. Quénu, observed drily, that it was rather far-fetched to call the skin "intact" of a man, with dry gangrene from obliteration of the femoral of several days' standing.

Burns. H. G. Weiskotten[5] made an *anatomic study* of 10 superficial burns. (5 in children and 5 in adults.) The ages varied from 19 months to 60 years. The interval between the burns and death varied from 5 hours to 20 days. The burns were produced in a variety of ways, scalding, burning clothes, explosion, etc.

More or less characteristic lesions were found in the suprarenals, lymphatic tissues, heart muscle and kidneys. These lesions, with those found in the other tissues examined, indicate the presence of a more or less specific poison in the circulating blood. Four of the 5 cases of over two days' duration showed punctate hemorrhage into the mucosa of stomach or intestine. In the one of 20 days' duration, punctate ulcers were evident in the stomach and duodenum. The lymphoid tissue of the intestine showed changes comparable to those found in the spleen and lymph nodes.

[The duodenal ulcers were first noted by Curling (of England) many years ago. There has been considerable discrepancy as to their presence, and it may be the necropsies when they were not found were done too soon after the burn for such changes to develop.—Ed.]

Alluding to *the paraffin treatment*, A. N. Collins[6] states he prefers plain paraffin with a dilution of 2% paraffin oil. In applying the dressing to a fresh burn for the first time, no attempt at cleansing the surface is made

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(5) Jour. Amer. Med. Ass'n, Jan. 25, 1919.
(6) Minnesota Med., January, 1919.

beyond spraying lightly with a 3 to 5% solution of dichloramin-T over which the paraffin is painted. Blisters are punctured but not removed.

At subsequent dressings any loose or sloughing skin is trimmed off with sharp scissors. This may be painful if trimmed too close. The secretions are removed by spreading smooth sheets of sterile gauze over the surface and blotting by gentle pressure. A cotton pad with a twisted pedicle for a handle may be used for this pressure. The surface is then ready for drying with an electric hair drier or blower, and the drying thoroughly done. Where there is infection with accompanying foul odor, the dried surface is then sprayed with dichloramin-T. In some places this may cause pain, and if this is immediately covered with paraffin oil sprayed on, the pain is relieved. For this purpose 2 atomizers are held in the left hand while the spraying-bulb is operated with the right. One contains the dichloramin-T in an oily solution, and the other sterilized paraffin oil. If at any time during the application of the dichloramin-T the patient complains of pain, the paraffin oil may immediately be sprayed on at that point. The surface is then ready for the paraffin crust. The mixture is heated in a double boiler and brushed on. It may be used in a paraffin atomizer with a water jacket if preferred. It may be cooled down until a few drops on the wrist are not uncomfortably hot. It is daubed on gently at first. Much stroking with the brush seems to cause pain. The raw surfaces are covered thinly at first. If the patient complains of the heat, an assistant may apply the electric drier to cool the freshly-coated surface following the brush. After the burned surface has been coated gently and is hardened, a second coat is freely applied and this coat is extended for 1 or 2 in. onto to the healthy skin. Before this dries, thin sheets of cotton fibre being ready, are spread over the soft crust and are brushed over with the paraffin which impregnates the fibre with the crust. When this is hardened, absorbent cotton is placed thickly over the most dependent edges to absorb secretions which commonly leak out. The dressings over large body-burns may be held in place by a band, swathe, slit nightshirt or other device which may later be cleaned, sterilized and used again, thus contributing to a large saving in bandage material. The dressing is renewed in 24 hours.

It has been said that with the paraffin method an infected wound is covered with a sealed dressing. Collins has found infection rapidly disappears with the use of the above method. It is also said there is no way of controlling the temperature of the paraffin; it is too hot at 212° and too cold at 144. If the paraffin is applied in conjunction with the blower the pain is reduced to the minimum and is only momentary. Certainly compared with the painful removal of gauze dressings according to the older methods, and considering the rapid proliferation of skin particles, the paraffin method is beyond reproach.

Experience in *31 cases due to forest fires* is related by A. L. McDonald.[7] Three types were fatal: (*A*) Two cases where over half the body was involved died within 6 hours. (*B*) Three with severe pulmonary congestion. (*C*) "Late toxemia" and exhaustion, a condition one could neither explain nor apparently influence, caused death in several. Most of them showed temporary improvement and some healing about the burns. The general condition of these 4 patients, however, was never satisfactory and there was little definite reaction from the primary shock.

He believes in the first aid care of extensive burns, the dressing with gauze soaked in 10 per cent. or stronger sodium bicarbonate and kept moistened is the simplest and gives greatest comfort. This is preferable to attempts at a more complicated technic. Morphin should be used to give rest but with care since there is often severe reaction and depression and the drug may do harm. Treatment of shock with posture, heat, hot drinks and stimulants may be necessary. Paraffin is much preferable to gauze with oily dressing and should be substituted as soon as possible, at least within 36 hours. With the air pump and atomizer the method can be simplified and rendered quite painless, dressings on gauze should be abandoned. Dichloramin-T in oil is painful and of slight value. If there is extensive slough, wet dressings or antiseptic powders are preferable. Ad-

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(7) Annals of Surg., March, 1919.

hesive strapping over the raw surface is highly satisfactory and simplifies the treatment since dressings may be extended to 2 or 3 days. The patient must be carefully followed and built up by stimulants, tonics or transfusions. Skin grafting is rarely necessary.

Fauntleroy and Hoagland[8] had occasion to care for 32 men *burned during a coal dust explosion* on board ship. The afternoon of admission 2 cases died—both very severely burned. Twelve hours following admission 3 more died. These cases, fully ⅔ of body having been burned, coupled with considerable smoke and fire inhalation. None of them rallied from initial shock. In 24 to 36 hours later 4 more patients rallied from initial shock only to pass quickly into a secondary depression with suppression of urine and coma. Careful use of morphin and continuous rectal drip with salt and sodium bicarbonate, although retained and absorbed in large amounts, seemed of no avail. All the fatal cases ran about the same course, coma, low delirium, suppression of urine and temperature of 104° and 105°—in 2 cases, 106°.

[We have found the use of normal salt solution introduced hypodermically (preferably under the breasts), in quantities of 1000 to 1500 c.c. every 6 to 8 hours, of great benefit in these cases. It should be given in addition to the proctoclysis.

The transfusion of whole blood by the method described by N. M. Percy, has given remarkable results in a few cases in which we have employed it. It is well worth trying in cases of extensive burns.—Ed.]

Their experience demonstrated the need for the quick institution of immediate general supportive measures. The value of fluids in large quantities by mouth and bowel, even before the so-called toxemia or acidosis symptoms commence. Later, during the absorption period, from large infected areas, the addition of the continuous use of small doses of morphin seemed of distinct advantage. It certainly serves to keep the patient quiet and thereby reserves his energy for later use. Too much stress cannot be laid on the value of these general measures, as a prophylactic, before the

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(8) Annals of Surg., June, 1919.

advent of toxic symptoms, which are sure to follow in one extensively burned. They are far more important than laying too much stress upon the burned area during this initial period. Patients extensively burned quickly go into a severe shock the first 12 hours. Reaction from this period may be followed by an equally fatal period about the 4th or 5th day. Recovery from this secondary period is later followed about 4th or 5th week by a period in which exhaustion is very important.

Their local procedures demonstrated the following: Initial antiseptic cleansing. Alcohol, boric acid solution, salt solution, Dakin's, Wright's solutions all proving equally efficacious. Gentle dressing manipulation during this period with trauma reduced to a minimum. As soon as possible the application of a simple protectorant, paraffin, ointment, gutta percha or rubber strips. No one procedure, or no one solution proves equally valuable for all cases. The individual question of how the particular area reacts to the solution used is an important one. There is a distinct difference between the mild stimulation and healing effect of bland protectants such as wax, liquid petrolatum and vaseline. The so-called "switching time" in the application of these various dressings is distinctly important. Some patients cannot tolerate open-air exposure. The absolute non-interference and non-removal of semi-adherent tags of skin is usually the best.

Tr. of iodin, introduced by Baumgarten (France) has been extensively used by O. F. Mercier[9] as the result of application to a burn on his own hand. The method is simple: Take absorbent cotton, soak it heavily in the tincture, holding it with a forceps, and put on a coat of it, liberally, all over the wound. If the patient is too nervous and too sensitive, give him first a hypodermic of morphin, or even it may be worth while giving him gas-anesthesia. Another very important point is the quality and strength of the preparation. The best is the one of the French Codex, or the 10-per cent. solution in *pure* alcohol, 90°. A simple sterile dressing with gauze compresses, and a bandage is quite sufficient. In fact, the solution is a dressing in itself,

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(9) Canadian Med. Ass'n Jour., October, 1919.

and in a few cases, he ventured to use no dressing at all, besides the liquid application, and kept the part open. The wound, after the application, covers itself with a thick, brown crust. The treatment must be made as soon as possible following the accident. If used on burns of the 1st and 2nd degree, it is a complete treatment and we do not need anything else, but there may always be spots where the burn would have attained the 3d degree, injuring the whole skin, and sometimes the adipose tissue, and even the muscles. For those deep burns, apply just the same, the iodin as for the surrounding surface, but of course, after a certain time, the destroyed parts must detach themselves, and this leaves a wound more or less large, which has to be treated by antiseptic dressings. To complete the cure and prevent the retractile scars, now is the time to appeal to Thiersch grafting. Where the burn is covered by blisters, it is important not to open them, and to let them dry up under the effect of the iodin in a few days and do not bring any complication whatever. In a few cases, when the patient was too sensitive, or for any other reason the pain was too great, Mercier replaced the tincture by the vapors of nascent iodin, but, of course, the first treatment was always by the tincture, in the way described, and the nascent iodin used only for the subsequent treatments, which must be applied then once a day, as with the tincture.

The time-tried *treatment by baths* was again successfully resorted to by D. Forster[1] in a boy, of 16, severely burned by gasoline. Urine was passed only at 12-hour intervals and in small quantities. On the 5th day he was put in a 2-per cent. boric acid solution, maintained at between 90 and 100 F., warming to the patient's desire and cooling when he seemed exhausted. He remained an hour, and on being removed, voided 16 oz. of urine. When taken from the solution, the bleeding parts, particularly the buttocks, were coated with an ointment having a petroleum base, while the rest was treated with paraffin after drying. If the surface is not dried, the application is very painful. The results of the immersion were so favorable that the next day

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(1) Jour. Amer. Med. Ass'n., Nov. 1, 1919.

he was kept in 3 hours, detaching dead skin and large sloughs. The bath continued daily, changing from boric acid to physiologic saline solution. It was remarkable to see the skin come in over the raw surfaces, growing as much as an inch in a day to cover a surface as large as two outspread hands. At the end of 3 weeks able to walk out.

The Surgical Complications Following Typhus are enumerated by Moure and Sorrel.[3] These generally supervene at the end of the febrile period or at the commencement of convalescence. The state of feebleness, predisposes patients to secondary infections. The causal germs can easily find an entry. On the one hand, bedsores frequently offer ready access; on the other hand, the dry and ulcerated buccal mucosa is a constant focus.

The frequent bucco-naso-pharyngitis readily explains the numerous cases of otitis and mastoiditis. Post-typhus parotitis has a similar origin to that in other prolonged febrile diseases, but this is in typhus, particularly frequent. It is favored by arrest of the parotid secretion leading to dryness of the mouth and rapid bacterial multiplication. The onset occurs at the end of the acute period, sometimes in advanced convalescence. They have seen all forms from simple parotid inflammation on one or both sides without suppuration to actual gangrene. The most frequent forms were the suppurative and gangrenous. The treatment was always a curved incision over the angle of jaw under local anesthesia or after a few whiffs of ethyl chlorid. Followed by opening up the gland with the curet, to remove at once a large part of the dead tissue, the gradual elimination of which was found to retard healing. Irrigation of the cavity with Dakin's solution rendered equally good service.

Large subcutaneous abscesses are very frequent in subjects recovering from typhus. They appear late generally, are progressive and almost silent, the patient generally calling no attention to them until an advanced stage. They are usually on outer surface of thigh or post. surface of arm, but are not unusual on calf, chest

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(3) Lancet, March 1, 1919.

wall and even abdominal wall. The clinical course is slow, this being most typical. They come thus to acquire enormous dimensions, occupying, *e. g.*, the whole length of thigh and separating two-thirds of the integument. On their surface the skin, slightly raised it may be generally appears normal, without redness, heat, pain, edema. Palpation gives a true sensation of fluctuation, because the pus, being under little or no pressure in the large sac which it does not distend, is easily displaced. It is not unusual to see successive pockets which permit fluid to be pressed from one into the other. Treatment is simple. It is necessary under local or general anesthesia to open completely the purulent sac. But it is not sufficient to evacuate the pus and to drain as for an ordinary abscess. It is necessary, after opening the sac, to evert the edges and energetically to curet the walls, to clear from them the granulation tissue and all the detritus of adherent connective tissue. Then, according to circumstances, the wound may be left widely open and irrigated with Dakin's solution; with secondary closure after disinfection has been obtained, or immediate partial closure may be performed, Carrel's tubes being left in to irrigate the partially closed cavity. But it is not exceptional to see, even after extensive operation, the infection spread up and down, necessitating new incisions. These streptococcal abscesses are particularly difficult to disinfect, and in a certain number one has to leave them to cicatrise spontaneously without any attempt at secondary suture.

Of all complications following typhus gangrene seems to be the only one which can rightly be credited to the still unknown pathogenic agent. Of these gangrenes 3 classes may be distinguished. The first includes *gangrene localised to the points of pressure,* which lead to confusion with bed-sores.

The second includes *gangrene of the lower limbs,* and particularly the feet, the pathology of which is still somewhat in doubt, inasmuch as it is difficult to decide the effect exerted on the arteries by the typhus infection, by secondary infections and by a third cause —the cold. A third class includes *gangrene localized to one part of the body* generally attacking the skin only, occasionally the deeper tissues. The scrotum is often involved, it may be attacked at a localized point or may invade the whole scrotum threatening the testes. On the trunk or arms, small patches were seen, sharply localized and coexisting with marbling, a very characteristic combination. The course was generally simple, the marbling disappeared steadily and small patches were cast off, leaving more or less deep ulcers which cicatrized progressively.

To the complications mentioned *erysipelas* must be added. Its frequency, known since Murchison and Trousseau, is easy to understand, seeing the almost constant presence of the streptococcus in convalescents. Danielopol reported 9 cases among 200 typhus patients. In some cases it supervened spontaneously, and was situated on the face, sometimes associated with lymphangitic abscesses. In others it supervened after intervention, such as incision of the parotid or of phlegmons, but especially after operations to adjust the stumps left by gangrene of the lower limbs. As a result of the incision a veritable inoculation occurred whatever antiseptic precautions were taken, and after an incubation of 3-5 days a typical erysipelas developed which impaired the outlook.

The treatment must envisage the general condition and the local complication. *A first main point is to avoid secondary infection by preventive treatment. For this it is necessary during the acute period and during convalescence to carry out careful hygiene of the skin and of the food and air passages.* The general often surpasses local treatment. It is necessary to struggle against the physical exhaustion and extreme physiologic want by good food, injections of serum, adrenalin, and the like. The local treatment varies with the particular localisation, it must be carried out in stages, regulated before all by the condition of patient. General anesthesia must be avoided as much as possible; when necessary it must be brief and cautious. In suppurative collections, after evacuation of the pus and curetting of the focus to eliminate the necrosed tissues they often employed discontinuous irrigation with Dakin's solution, and have seen operation wounds thus become sterile; they have even gone on to secondary suture, in spite of the streptococcus. Possibly certain varieties of streptococcus were less virulent, as the attenuation of the general symptoms suggested; perhaps the patients, who were often septicemic, had acquired a certain immunity. This immunity might, moreover, be accentuated by antistreptococcic serum.

[See also complications of typhoid (Murphy) 1917 volume, (Webb-Johnson) 1919 volume.—Ed.]

Myositis Ossificans. A man, aged 22, with the *progressiva* type, was under the observation of J. Rosenstirn[4] for several years. A swelling in groin was noted soon after birth. The *x*-ray highly praised by French authors was used without effect, except perhaps to stimulate new growths.

After an exhaustive consideration of the subject the author arrives at the conclusion that m. o. progressiva is a misnomer and would better be named fibrocellulitis ossificans progressiva. The disease nearly always commences at an early period of life and shows as additional symptoms a microdactylia of fingers and toes, and in some cases a more or less pronounced infantilism.

Similar to the primary hemorrhage of the traumatic m. o. the introductory pathologic process in the progressive form is an initial intercellular capillary hemorrhage which starts the growth of newly-formed connective tissue surrounding the extravasation without any previous hypertrophy of the adjacent connective tissue. Calcification and ossification take place at first at the newly-formed connective-tissue strands encircling the hemorrhagic mass, and with few exceptions from within out. There is an apparent active participation of the enclosed erythrocytes in the bone-formation; they change their round to a spindle-cell shape and seem to become nucleated as they approach the osteogenetic edge of the encircling ring and merge into its substance. The microdactylia has an endogenetic origin and is the result of an "anlage" defect of the carpal and tarsal tissue rays. The initial hemorrhage from the capillaries is probably due to the same cause. The hemorrhagic effusion with its calcium content starts the first deposit of lime, and

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(4) Annals of Surg., November, December, 1918.

indirectly stimulates its continuation by a nutritive impairment from pressure of the extravasation. No therapeutic measures against the products or progress of the disease have proved of any value.

Reporting 3 typical examples of the *traumatica* type, in males of 28, 54, and 63, T. G. Orr[5] observes the principal point to remember in *diagnosis* is the importance of distinguishing between intramuscular ossification and periosteal sarcoma. Many times the former has been diagnosed sarcoma and amputation advised or actually done. The consistence is much harder than in sarcoma and more uniform in character. Rarely is there pain in the early stages of sarcoma. In m. o. the pain is apt to be an important feature in its early development. Bone lesions other than sarcoma may be considered in the diagnosis, but they all have characteristics that usually make them easily distinguishable.

The *prognosis* depends on the location of the mass and to what extent it may interfere with function. The bone formation is very apt to recur if removed early. If permitted to "mature" or "ripen," the likelihood of a cure is much greater. In a great many cases restoration of function is complete or nearly so without operation. The mere presence of bone in muscle does not seem to cause any disturbance. The consensus of opinion is the *treatment* should be conservative. There are cases in which operation is very definitely indicated because of the functional disturbance caused by the presence of bone. Even in such cases it is wiser to wait until the development has reached a standstill, to avoid liability of recurrence. If operation is done the growth should be carefully removed down to the normal bone if it is attached to bone. Morley has made a new limiting membrane to cover the bone by transplanting the deep fascia. Shere is more radical than the average, and urges that all early cases be treated by converting the closed into an open wound. He bases this on the belief that traumatic ossification occurs only in closed wounds and in some cases the condition should be looked on and treated as presarcomatous.

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(5) Jour. Missouri State Med. Ass'n, February, 1919.

Granulomata. Some surgeons maintain that *syphilis does not retard the healing of wounds*, but J. de Mendonça's experience[6] has convinced him that syphilis, as well as other constitutional diseases, is liable to exert a most unfavorable influence on operations, especially laparotomies. In 3 recent cases, the laparotomy wound opened again, or there was dilatation of stomach and intestines. The Wassermann was strongly positive, and under specific treatment healing proceeded further without mishaps. Other instances are reported of complications in skin, etc., after operations on syphilitics, all emphasizing the wisdom of preliminary specific treatment.

[See also Bones and Abdominal Surgery—General. —Ed.]

S. A. Heyerdahl[7] gives details of 5 cases of *actinomycosis successfully treated with radium*. The patients, all males, were from 18 to 79 years, and the lesions were on face and neck.

[The administration of 90-grain doses of potassium iodid in ½ pint of milk, followed by one pint of hot water, three times daily at intervals of 8 hours for three successive days, with intervals of one week during which time no KI is administered, is of great value in the treatment of actinomycosis and similar conditions—like blastomycosis and granulomata. This should be used in addition to radium and *x*-ray treatment, and excision where this is possible. It is wise to repeat this treatment with enormous doses of KI for periods of three days at intervals of a month, for several months after the patient has apparently recovered, in order to insure against recurrence.—Ed.]

Reference is made by J. L. Yates[8] to a *recognition of local and general resistance as guides* in the treatment of certain chronic malign affections. It is well known there may be a long latent period (26 years) between operation and final metastatic activity, hence there is no possible arbitrary time limit to establish a cure. Surgeons of extended experience can cite patients who have

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(6) Brazil-Medico (quoted in Jour. Amer. Med. Ass'n, March 1, 1919).

(7) Jour. Amer. Med. Ass'n, Dec. 27, 1919.

(8) Wisconsin Med. Jour., September, 1919.

made an apparently perfect recovery from an incomplete operation performed years previously. Due consideration of these facts in connection with knowledge of the clinical manifestations of the terminal phases of cancer development, and with the experimental observations of James B. Murphy and associates, gives adequate bases for the existence of fluctuating influences antagonistic to some types of malignant growths. In addition to tumors of this group there are the chronic granulomatous affections, which at some time have been held, to be quite as commonly lethal. *E. g.*, Hodgkin's disease is believed to be irrecoverable, and considered by some to be a granuloma, by others to be a neoplasm and by still others a granuloma with a tendency to provoke malignant metamorphosis of tissues involved, endothelial, lymphoblastic or fibrous. This last view point is probably sustained clinically and pathologically and makes an excellent connecting link between pure neoplasms on the one hand, and granulomas with little or no tendency to induce malignant changes. Tuberculosis is typical of this latter category. Its untoward effects are subject to individual variation and to variations due to the tissues involved. Meningeal, renal, peritoneal, pleural or even glandular tuberculosis may be just as malignant as any cancer in its results in divers proportions of individuals thus affected. Blastomycosis and actinomycosis have this vicious potentiality more highly developed.

There is good reason from a therapeutic aspect to collect into one group those morbid processes which provoke similar defensive reactions though the etiology and proportion of consequent fatalities show a wide dissimilarity. Studies of chronic surgical affections of this type conducted with the intimate co-operation of C. H. Bunting have led to a tentative inclusion in such a group of the following:

I. Tumors.

  (a) Carcinoma
  (b) Endothelioma
  (c) Lympho-blastoma (Mallory)
  (d) Lympho-sarcoma
  (e) Mesothelioma

II. Granulomas.

- (a) Tuberculosis
- (b) Hodgkin's disease
- (c) Lymphocytic leukemias
- (d) Actinomycosis
- (e) Blastomycosis

The object in treating disease is not to cause a disappearance in its manifestations but to eradicate the cause. None may present evidence of successful treatment and expect the same to go unquestioned, if the process at the time treatment was begun had not assumed the characteristics that establish its lethal nature were it left untreated, and if a careful necropsy made years later failing to show a trace of the original process is not included.

Adequate treatment must be based on physiologic reactions, and offer to each individual every opportunity for complete recovery, and not be biased by any successes, real or apparent, attained by short-cuts. No single form of treatment by surgery, radiation, serum, hygiene or internal medication has as yet been found sufficient. A co-ordination of all these therapeutic agencies now seems to offer the best chances, with—of course—the usual exceptions.

The argument of a general plan for treating these affections may be summarized under 3 heads:

I. *Elimination of irritants.* The primary focus should be destroyed permanently by the most suitable means, knife, cautery, or radiation, or combination of these. The regional area of lymph nodes and gland-bearing tissue should be extirpated accurately. The earlier the process, the more radical should be the excision. Any other accessible involvement should be similarly treated so long as the general condition warrants it, because such a focus becomes in effect primary.

II. *Conservation of local defenses.* Protection of local resistance, after elimination of the specific irritant is attained, is going to depend on the character of repair that follows extirpation. This will be satisfactory in proportion to the integrity of blood- and nerve supply, and to the reduction of limitation of function by avoidable fibrous tissue formation. Radiation has not been found as capable of destroying the sources of local irritation with as good prospects of unimpaired local resistance as has suitable dissection. A regeneration of lymph apparatus in an excised area cannot be prevented nor would this be desirable if possible. Function would suffer, but more important still, the individual would be deprived of the benefits of these new lymph structures, which seem to be hyperresistant and to contribute to the general protection. Great advantage can be obtained from radiation after operation. Properly given, the *x*-ray can destroy toxin-forming cells that operation fails to remove. It can retard the regeneration of lymph structures until destruction of the offending cells or organisms has been accomplished and thus reduce the danger of local recurrence. It can also do great damage, by burns, by provoking serious hemorrhage and by interfering with healing, but also by its effect upon the body. Whatever may be found to be the explanation, radiation of the circulating blood can produce profound changes particularly in reducing the lymphocytes. A rapid and persistent fall in the number of lymphocytes has regularly heralded approaching disaster. It is possible these observations may explain the occasional stimulation of malignant activity by the *x*-ray. For this reason the dosage and periodicity of treatments should be controlled in part by the blood reaction.

III. *Maintenance of unimpaired general resistance.* The real problems lie in this field which has been woefully neglected because attention has been centered upon the physical to the neglect of the physiologic aspects, and because of a superstition the surgeon completed the treatment at operation. The hygienic measures are no less important than in the after-care of patients discharged, with arrested disease, from a tuberculosis sanitarium. Drugs are of use not as specific remedies, but as tonics, laxatives and the like. Specific antiserums have not been satisfactorily developed. Non-specific foreign protein reactions have still to be found generally advantageous, though occasionally injections of Coley's mixed toxins have preceded material improvement.

An important question is should attempts be made to induce a lymphocytosis? If experience along similar lines in treating acute intoxications by induced leukocytosis be taken as a guide, there can be no doubt. The problems are, however, not identical. Routine stimulation of lymphoblastic tissues by tuberculin (Dabney), by the x-ray or electric light (Murphy), by ultra-violet rays, or exposure to direct sunlight, may ultimately be found to be more often beneficial than otherwise. A safe attitude is to avoid everything known to depress lymphoblastic activity as indicated by the lymphocytes in the blood, an exception being in the presence of a hyperlymphocytosis. Probably the most serious errors are committed in over-exposure to the x-ray and more particularly to radium. Yates has seen immediate and some prolonged benefits from stimulating lymphoblastic tissues by sunlight, x-ray, electric light, tuberculin and in one instance by a slight intercurrent pulmonary tuberculosis. He also saw harm come from attempts to stimulate tissues that were fatigued. Preceding or during the course of x-ray treatments, when conditions are critical and there is a tendency to lymphopenia, induced lymphoblastic activity seems to be of value.

Observations must be continued over long periods. Temporary fluctuations are common and comparatively insignificant. In acute infections, a bacteriemia now known to be common was formerly believed to be rare. In these chronic malign affections there is probably less complete focalization than has been suspected. At any rate the treatment of these diseases as actual systemic invaders, no matter how recent the development, and how apparent the localizations can do only good when that treatment must put the individual in the best possible condition. A step farther in the same philosophy, refusing to accept limited systemic invasion as a proof of irrecoverability leads to a more commendable attitude towards individuals in whom disease is more advanced when treatment is begun.

So long as general resistance is good, with the bone marrow and lymph tissues still capable of normal function, there is hope, if extirpation of the major portion of diseased tissue is a possibility.

Benign Tumors (xanthic extraperiosteal) of the extremities *containing foreign body-giant cells* are elaborated by A. C. Broders[9] of the Mayo Clinic. There are numerous synonyms, *e. g.*, myeloid sarcoma, myeloma, myeloid endothelioma, myeloxanthoma.

A series of 17 tumors was examined, from 6 male and 11 female patients; average age 47.2, youngest 21, oldest 65. Ten were on arms (wrist 1, fingers 9), and 7 on legs (ankle 3, foot 1, toes 3). There was a history of injury in 6, and of infection in 2. The shortest duration was 8 months, the longest 24 years, with an average of 7.6 years. Local excision was done in 12, combined with cautery in 2, amputation in 3. Of 15 patients who could be traced, 1 died of old age. There had been no recurrence on an average of 3.5 years with extreme of 8.4 years since operation.

All the tumors contain typical foreign body-giant cells. In part of the tumors these reach as high as 40 to the low power microscopic field, while in other areas of the same tumor only a few scattered cells can be seen. Some of these contain a small number of nuclei, others as many as 100. The nuclei, on the average, are slightly larger than the small lymphocytes and are round or oval with a fairly regular outline containing small nucleoli. They bear a striking resemblance to endothelial cells. Some of the cells are in apposition to blood pigment, others in direct contact with the surrounding cells or in open spaces. These giant cells are like those found in the medullary giant-cell tumor of bone and of the gum, and like those which collect around cholesterin crystals, blood pigment. Microscopically the tumor appears as an encapsulated grayish or brownish or pinkish yellow lobulated mass. Whitish streaks of fibrous tissue connected with the capsule may be seen between the yellow areas. The tumor is rather firm and tough. It differs from the foreign body-giant tumor of the bone marrow and of the gum in that the latter tends toward a reddish tinge, closely resembling the color of grape juice, and in its tougher texture. Some of the tumors of the bone marrow, however, are exactly like the yellow extraperiosteal tumors. A number believe this type of tumor originates in the tendon sheath; as a matter of fact, 16 of the 17 tumors of Broders' series were intimately con-

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(9) Annals of Surg., November, 1919.

nected either with the sheath or with the tendon; one, however, was between the skin and superficial fascia.

It may be concluded, therefore, he adds, after thorough macro- and microscopic examination of these 17 tumors, and a consideration of the clinical history and ultimate result, that it is justifiable to call them benign growths, which are probably the result of the extravasation of blood following injury or infection, as they seem to have more of the microscopic features of a granulation tissue tumor than of a true neoplasm. Under no consideration should they be called sarcomas.

SHOCK.

To avoid confusion, E. M. Cowell[1] has introduced the term "*wound shock.*" From time to time cases of death from pure shock may possibly occur, but in war surgery no case has yet been reported where it was possible to exclude either macro-or microscopic anatomic damage in one of the vital organs. In the shock met with in civil surgery there are almost invariably factors of severe tissue trauma, toxemia, hemorrhage, or psychic disturbance present, which study of wound shock has shown to play such an important part in the initiation of the condition.

Serious wounds do not always produce shock. Where, however, the damage sustained by the body is such that anatomic death must supervene unless intervention is possible or available, the pressure falls with great rapidity and the symptoms of wound shock are found to have become established as soon as the patient is seen. In war surgery, at any rate, it is doubtful if such a state of affairs ever occurs apart from hemorrhage. To this class Cowell gives the name "primary wound shock." It is unavoidable, but one which in favorable cases may be kept from progressing and later terminate in recovery.

In a large proportion of the serious wounds symptoms of shock supervene after some hours. Early observations showed no alteration in pulse-rate or blood pressure level. During the next few hours, however, in the presence of certain factors, the pressure was found to fall, the pulse-

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(1) Lancet, July 26, 1919.

rate to rise, and the state of shock to become established, "secondary wound shock."

The figure (left hand) shows diagrammatically the possibilities in a case of primary wound shock. From a practical point of view the importance of closely watching during the period immediately subsequent to the onset cannot be too urgently insisted on. Otherwise the favor-

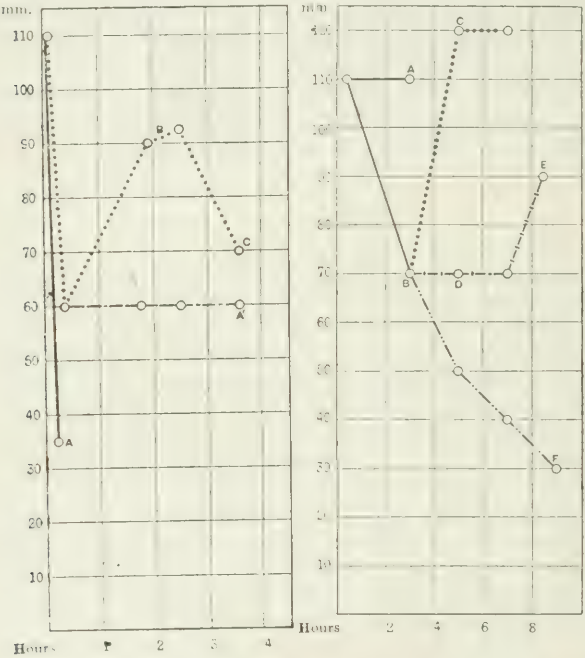

Fig. 28. (*Left*) Primary wound shock curves (diagrammatic). Following a severe anatomic injury, instant wound shock may develop, which may be fatal in a shorter or longer time, as shown at *A* or *A′*. Under favorable circumstances the pressure may rise to *B*, dropping later to *C*. At this point the primary has merged into secondary wound shock.

(*Right*) Secondary shock curves (diagrammatic). In many of the cases of moderately severe wounds the pressure will remain level at *A*. In others it falls with the establishment of secondary wound shock, *B*. At this point the patient may react quickly to treatment, *C*, or after more prolonged treatment at *D*, to *E*. In the absence of favorable circumstances, the pressure goes steadily down, and the case terminates fatally in from 12-24 hours, *F* (Cowell).

able moment, *B*, will be missed, and the primary merge into secondary shock without the patient being given the benefit or opportunity of intervention. The behavior of the blood pressure in secondary wound shock is charted diagrammatically. (Right hand figure).

Just as wound shock may be produced in a few min. (primary wound shock), so in certain rare instances surgical shock may develop as the result of a sudden nerve stimulus, with or without hemorrhage, or in an operation probably associated with unsatisfactory anesthesia. These uncommon cases show themselves as instances of cardiac weakness or inhibition, demanding special treatment, *e. g.*, cardiac massage.

The bulk of the cases of surgical shock, however, correspond to the common variety of wound shock—*i. e.*, the secondary shock—the pressure falling towards the end of operation or even after the patient has been returned to bed. Undue anxiety, chilling, pre-existing bacterial toxemia, or hemorrhage are all pre-operative factors to be taken into consideration. During the operation further loss of heat, the amount and nature of anesthetic, question of hemorrhage, and most important, the amount of trauma to which muscle tissue is subjected, all play a part in the production of secondary surgical shock.

With regard to tissue trauma, as Wallace has pointed out, the amount of shock resulting from a forequarter amputation, where the limb is removed along tissue planes, and where only a small muscular mass is divided, is, as a rule, small compared with the amputation through the hip-joint, where large muscular masses are traumatised. The beneficial effect of regional or spinal anesthesia may, perhaps, be explained on these lines. There is complete relaxation, permitting of the handling and retraction of the muscle substance with the least amount of bruising and damage. The handling of the more important organs does not in itself necessarily produce shock. Cowell took continuous pressure readings while the lung was being "exteriorised" and the hilum dragged on, without being able to detect any tendency to hypotension. The surgeon in treating shock should bear in mind the following points:

1. The psychic aspect of the case. Any undue appre-

hension or excitement should be allayed by quiet persuasion, suggestion, or by small doses of morphia.

2. The loss of circulating fluid and body heat. In preparing a case of shock for operation what has come to be known in war surgery as "resuscitation" is carried out. Warmth is applied by the most suitable means at hand, while the patient is made as comfortable as possible and allowed to rest. Fluids are freely supplied by mouth or rectum. If the pressure does not quickly rise gum saline is given intravenously. When it is thought actual loss of blood is the chief factor, then transfusion of whole blood should be carried out with as little delay as possible. By these means the condition can be sufficiently improved to allow of the surgeon performing anatomic repair and getting rid of the toxic material.

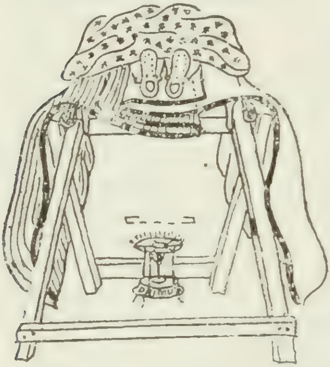

Fig. 29. Method of applying warmth. Patient heating up.

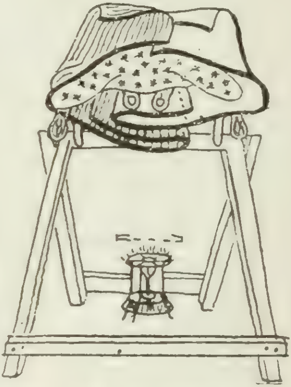

Fig. 30. Same. Ready for transport. Dotted line over lamp is kettle or iron plate (Cowell).

3. During operation in such cases, or where the anatomic intervention contemplated is at all extensive, the surgeon should insist on gas and oxygen either alone or combined with regional anesthesia. During the operation a falling pressure may be counteracted by giving 500-1000 c.c. 6 per cent. gum solution in normal saline. There is no evidence of any permanent benefit following

injection of any of the numerous drugs recommended from time to time.

Concerning *wound shock and its treatment,* J. E. McCartney[2] tells us that injury to muscle tissue causing a traumatic toxemia is one of the main features causing secondary shock. Other probable secondary factors are hemorrhage, cold, fatigue, pain, and lack of food. The result of shock is to cause a marked lowering of blood pressure, and the consequent anemia affects especially the nerve centres. (In this connection Mott examined some of the brains from fatal cases, and found degenerative changes in the nerve cells such as appear when the brain has been anemic for some time.)

In resuscitation work the treatment of 3 phenomena has alone yielded successful results, namely: (*a*) Lowering of body temperature. (*b*) Lowering of blood pressure. (*c*) Diminution of blood volume. It is the cases of hemorrhage combined with little shock which form the successes in resuscitation work. The treatment of acidosis by intravenous injection of sodium bicarbonate has little or no practical value in shock.

(McCartney also refers to another distressing case due to the hurry of war surgery: He found the gum solution had been made with water from a shallow well instead of distilled water. A bacteriologic examination showed *B. coli* present in 0.01 c.c., while the number of colonies that developed in 1 c.c. on agar plates was innumerable. The effect therefore of the introduction of 500 c.c. of this gum solution was to give an intravenous vaccine of many hundreds of millions of dead organisms. No wonder there were rigors!)

Erlanger and Gasser[3] take up *gum acacia and glucose in shock.* On the basis of their own and other animal experiments, they believe that slowing of the circulation in a considerable part, or in the whole, of the body is commonly, if not always, the factor that leads to the development of experimental shock. It is believed from slowing of the blood-stream the corpuscles clump in the venules and capillaries which then become choked with solid masses of corpuscles and dilate. The flow is thus

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(2) Edinburgh Med. Jour., September, 1919.
(3) Annals of Surg., April, 1919.

curtailed still further, indeed, to the point of interfering seriously with tissue respiration and nutrition. The effective blood-volume is reduced, not alone by the dilatation, but also by transudation of plasma. The organism strives to combat this real and effective reduction by the usual mechanism of pouring tissue fluids into the blood-stream. Largely, if not exclusively, as a result of the deficient general circulation resulting from the reduction in effective volume, the medullary centres, including the vasomotor, and the heart, eventually may show some functional insufficiency.

The administration of a combination of hypertonic gum acacia and hypertonic glucose under these circumstances acts beneficially in several ways: (*a*) By drawing fluids from the tissues into the blood-stream, thus assisting the normal mechanism in restoring the blood-volume. It is possible such an *internal transfusion* carries from the tissues into the blood-stream a certain amount of proteins and of salts so the fluid thus added to the blood might resemble much more closely the composition of the plasma than could any artificial solution. (*b*) By maintaining this increased volume through some property of the acacia. (*c*) By dilating the arterioles through some specific action of the hypertonic crystalloid. (*d*) By increasing the energy of the heart beat in the same way, and also through direct action of the glucose on the muscle. And (*e*) by augmenting metabolism through the increase in the supply of glucose to the organism between the limits of basal metabolism and self regulation. There is no need of providing salts with this injection, because the solution is given in relatively small quantity (5 c.c. per kilo of body weight) and very slowly. It can be assumed it is given so slowly that the salt balance of the blood can be maintained by interchange with the tissues, while the salt balance of the tissues, since the body contains 700 c.c. of fluid per kilo, would not be appreciably affected. The withdrawal of water from the tissues seems to do no harm, and the loss that does occur should be made good by mouth, by rectum, and hypodermically.

But even if their views with regard to the cause of the circulatory disturbance of shock should not withstand the test of time, and the theoretic reasons for using glucose or gum acacia should prove wrong, there would still remain the empirical tests which show definitely that the gum-glucose solution saves a certain number of animals from death by trauma. The results obtained through the use of the solution in the treatment of shock-like states in man, and after hemorrhage, are not so easily interpreted as are the animal experiments. But they show conclusively the solution is innocuous, and are strongly suggestive of beneficial action.

G. W. Crile[4] remarks that *during the war* the subject of shock was studied on an enormous scale. The principal measures entering into the treatment are: 1. Rest. 2. Head-down posture. 3. Heat. 4. The *intravenous* administration of saline. 5. Blood transfusion, which was recognized to be the best of all. 6. Morphia.

All the other measures which were used at one time or another did harm and were discarded.

TETANUS.

Statistics. Several summaries by D. Bruce of the *prevalence in military hospitals (England)* have been cited. The latest[5] brings them up to April, 1918, and the total number and mortality were:

TABLE I.

Analyses	Cases	Rec.	Died	Mortality %
1914-15	231	98	133	58
1915-16	195	99	96	49
Aug.-Oct., 1916........	200	127	73	37
Oct.-Dec., 1916	100	69	31	31
Dec., 1916 to Mch., 1917	100	81	19	19
March-June, 1917	100	71	29	29
June-Sept., 1917	100	85	15	15
Sept.-Dec., 1917	100	84	16	16
Dec., 1917-April, 1918..	100	76	24	24
Total	1226	790	436	35.5

The diagram shows the incidence per 1000, from date of wound, not from onset. In November, '14, there was

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(4) Railway Surg. Jour., November, 1919.
(5) Lancet, March 1, 1919.

an abrupt fall due to use of prophylactic injections from Oct. 15.

Table II gives the average incubation of cases from August, '14, to April, '18. Table III the percentage with short, medium, and long incubation periods since the beginning to April, '18.

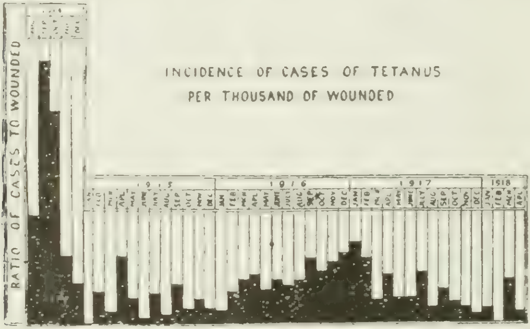

Fig. 31. Prevalence of tetanus in military hospitals (Bruce).

TABLE II. TABLE III.

Analyses	No. of cases	Average incubation Days	To 10 days %	11 to 22 days %	More than 22 days %
1914-15	231	13	47	46	6
1915-16	195	31	16	49	36
Aug.-Oct., 1916	200	31	14	44	42
Oct.-Dec., 1916	100	45	13	27	61
Dec., 1916, to March, 1917	100	67	10	21	69
March-June, 1917	100	44	20	34	46
June-Sept., 1917	100	56	15	24	61
Sept.-Dec., 1917	100	47	13	31	56
Dec., 1917, to April, 1918	100	47	26	29	45

In the sixth analysis there were 80 cases of general and 20 of local tetanus with a mortality in the former of 36.2 per cent. There were no deaths among the local cases. In the seventh, eighth, and ninth analyses there were 223 cases of general and 77 of local tetanus. The rate of mortality in the former was 25 per cent., in the latter there were no deaths.

TABLE IV. POSITION OF WOUNDS AND MORTALITY %.

	III	IV	V	VI	VII	VIII	IX
Body	32	37	20	18	18	19	28
Limbs	68	27	17	36	13	13	20

TABLE V. EFFECT OF FRACTURES IN LAST 400 CASES.

Wounds	Cases	Recovered	Died	Mortality %
Fractures	157	119	38	20.4
No fractures	243	197	46	19.0

The last 400 cases received serum, and 84 died (21%). In the following table is the influence of dosage on the curative action:

TABLE VI.

	(A)				(B)			
Units received	No.	Rec.	Died	%	No.	Rec.	Died	%
1,000 or under...	1	1	0	0	5	5	0	0
1,001 to 5,000..	10	10	0	0	70	62	8	11
5,001 to 10,000..	19	12	7	37	131	120	11	8
10,001 to 15,000..	23	20	3	13	74	60	14	19
15,001 to 20,000..	10	9	1	10	46	34	12	26
20,001 to 30,000..	43	26	17	39	46	21	25	54
30,001 to 40,000..	47	37	10	21	19	10	9	47
40,001 to 60,000..	61	41	20	33	7	3	4	57
60,001 to 100,000..	90	73	17	19	2	1	1	50
100,001 upwards ...	96	87	9	9				

(A) Total quantity of antitoxin given during the attack.
(B) Daily quantity of antitoxin given.

Leishman and Smallman's figures on the *prevalence in the B. E. F. (France)* were also referred to in the 1918 volume (p. 165). These have been continued to Dec. 31, 1917, by Cummins and Gibson,[6] using the same classification. While dealing with smaller numbers they are interesting for comparison with Bruce's figures.

TABLE I. MORTALITY COMPARED WITH FORMER SERIES.

	Cases	Died	Rec.	Case-mortality
July, 1915	179	140	39	78.2%
July-October, 1916.	160	118	42	73.7%
Present series	376	252	124	67.0%

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(6) Lancet, March 1, 1919.

TABLE II. CASE MORTALITY IN EACH GROUP.

	Cases	Died	Rec.	Case-mortality
(a) British battle casualties	291	191	100	65.6%
(b) "Trench feet"........	24	21	3	87.5%
(c) Accidental	48	26	22	54.1%
(d) German prisoners	13	9	4	69.2%

TABLE III. CASE MORTALITY OF PRESENT SERIES.

	Cases	Died	Rec.	Case-mortality
1st group	63	47	16	74.5%
2nd group	63	48	15	76.1%
3rd group	63	45	18	71.4%
4th group	63	40	23	63.4%
5th group	63	36	27	57.1%
6th group	61	36	25	59.0%

The relative frequency of body and limb wounds follows. (Where both occurred in the same patient it was counted as a body wound only.)

TABLE IV. RATIO BETWEEN THE NUMBER OF CASES SUFFERING FROM WOUNDS OF THE LIMBS AND BODY.

Series	Body		Limbs	
July-October, 1916: 157 cases....	79.	50.3%	78.	49.7%
Present series: 371 cases.........	144.	38.8%	227.	61.1%

TABLE V. THE POSITION OF THE WOUNDS IN REFERENCE TO CASE MORTALITY.

Series	Body		Limbs	
Fatal cases: 251.................	102.	40.6%	149.	59.3%
Recoveries: 120	42.	35.0%	78.	65.0%

Records of the incubation are available in 343 of the 376 cases. This varied from 18 hours—a gunshot wound of thigh with fracture of the femur in which no history of any previous injury could be elicited—to 180 days. This latter case has been eliminated for the purpose of working out the average incubation period, which, for 342 cases, was 13.2 days, a little over a day longer than the previous analysis. Of the 230 fatal cases, the average period was 12.5 days compared with 10.7 in the July-October analysis, and of the 112 recoveries 14.9 as compared with 14.0 days. The difference in the incubation period of fatal cases and recoveries is 2.5 as compared with a fraction over 3 days in the last analysis and 2.75 days in that of July, 1915. The close connection between the length of the incubation period and the case mortality should not be lost sight of in comparing the results of treatment in England with those in France.

Tetanus occurred after amputation in 59 cases, or in 15 per cent. of the series. Of these, 38 died as a result of tetanus, while 6 died from sepsis and other causes after the tetanic symptoms had subsided. Among the 59 cases 42 occurred after amputation of the leg, and 16 after amputation of arm, while in one case both an upper and a lower limb had been amputated. Among the amputations of the lower limbs in which tetanus subsequently developed the mortality was 76.3 per cent.; in the upper limbs 60.0 per cent. The one patient in whom both an upper and lower limb were amputated recovered, but died from pneumonia 30 days later.

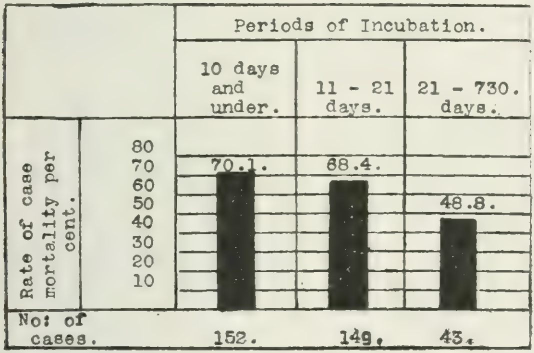

Fig. 32. Relation between incubation and case mortality of tetanus (Cummins-Gibson).

Operation was resorted to after the appearance of tetanic symptoms in 27 cases; 22 died and 5 recovered, a mortality of 81.48 per cent. This is even higher than in the last analysis, 77.7 per cent.

The authors close their article by stating that analysis of the case-sheets cannot be said to give any very clear indication as to the value of antitoxin treatment. A steady fall in mortality has undoubtedly taken place. Where, however, so many factors may have played a part, the greatest caution should be exercised as to how this improvement has been brought about. It must be admitted that antitoxin has, up to the present, failed to produce such a striking improvement as to be at once apparent in statistical records. On the other hand, the dosage has been small. The union of toxin and antitoxin may be assumed to take place on quantitative lines. Since we are still ignorant of the actual quantity of toxin requiring neutralisation in the average case, we cannot accurately decide whether the dosage hitherto has or has not been on an adequate scale. On theoretic grounds they are inclined to the opinion the dosage has not been large enough. A point of more importance is that the use of antitoxin is gaining ground among those charged with the care of cases. It is clear, at least, no ill-results follow this tendency to increase the dosage, as the mortality has fallen synchronously with it. When serum therapy is employed the antitoxin should be given at the earliest possible moment and in large doses.

Delayed Tetanus. Especial interest attaches to 2 cases reported by W. L. Whittemore[7] owing to the fact that after apparent recovery had taken place, there occurred at a later date similar though milder attacks. These men were wounded, one 3½ and the other 9 months previous to the onset. In the second case, 3 months after the wound an operation was performed in the neighborhood of the healed wound which may have resulted in an acceleration of the development of the disease. In both cases the local symptoms and signs were in evidence 2 and 3 weeks before the onset of the secondary, generalized tetanus. From being mildly ill when the signs were localized, both men became dangerously ill when the symptoms became generalized, showing, in sequence, pain, stiffness, clonic contractures in the wound areas, increasing trismus, photophobia, opisthotonos, with later an emprosthotonos, excessive dyspnea, and cyanosis. Eye complications developed—in one keratitis, in the other iritis and conjunctivitis.

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(7) Jour. Amer. Med. Assoc., Dec. 24, 1918.

The intelligence comparatively unaffected until both had reached very critical stages.

E. S. Harde[8] observes that *this form develops* some weeks—or even months—after the wound; it often follows a secondary operation. Here 2 factors must be considered: (*A*) It is well known that tetanus spores can remain latent a long time without provoking symptoms. Following trauma, such spores may undergo development and tetanus start up. (*B*) There is a second possibility—contamination in the hospital during interventions or dressings. Some hospitals have a much larger percentage of late tetanus than others. Possibly these receive patients from regions particularly subject to tetanus infection; but that may not be the only explanation. In former researches Harde met with 2 cases where the wounds contained the bacilli, without any clinical manifestation of tetanus. One was gas gangrene affecting a large wound of thigh and knee; patient died on 10th day. In the other there was a wound of thigh. The examination had demonstrated the presence among other micro-organisms of septic vibrio and tetanus bacillus. The wound became rapidly clean and no complications followed. As the Hôpital Buffon (Paris) he studied 30 consecutive non-tetanic cases. The wounds studied date from some days to several months; all, after opening up, treated by the method of Carrel-Dakin. The micro-organism of tetanus had not been found.

With these negative results it seemed important to search for the bacillus on the projectiles extracted from wounds. The opportunity was given by Depage at La Panne. The result of the examination of 58 fragments of projectiles and 2 rifle balls, taken from wounds, was, first, that the bacillus of tetanus has been found once (1.66%); that anerobic germs of many kinds, often associated with streptococci, have been observed in 86.69 per cent. of the cases, without any of these patients having later presented gas gangrene or of grave infection due to anerobic bacilli.

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(8) Annals of Surg., January, 1919.

MALIGNANT TUMORS.

Statistics on *37,666 deaths from cancer* in its policyholders are furnished by the Metropolitan Life Insurance Co.[9] The period covered embraces 6 years, and the rate was 70 per 100,000. It is asserted: "Cancer death rates in this present experience, covering six calendar years, and relating in all to 50 million years of life exposed to risk, show no decisive upward or downward tendency for all age classes combined." According to the statistics, cancer was responsible for 59 per cent. of all deaths, and stood sixth in importance as a cause.

Among white males, cancer was the cause of 4.3% of all deaths; among white females, 8.5%; among colored males, 1.8%, and among colored females, 5.2%. Cancer of the stomach and of the liver caused 37.6% of all cancer deaths. Commencing with 3.7 per 100,000 (between 1 and 4 years), the rate reaches the minimum (1.3) between the ages of 10 and 14, increases slowly to 4.1 between 20 and 24, and mounts rapidly to 15.7 between 25 and 34. In white females, the leap in this period is from 3.7 to 18.5, and then to 99.3 in the age period of 35 to 44. In the latter period, marked increases occur in the mortality from cancer of the genital organs and of the breast.

[Six years is probably too short a time to anticipate any "decisive upward or downward tendency."—Ed.]

Etiology. "A glance" is taken by J. R. Pennington[1] at *some of the old and new theories on the causation of cancer.* While not all the causes alleged, are considered, of course, many of the whimsicalities are, and the essay represents an enormous amount of work, the references numbering 86.

Starting with the parasitic theory, which dates back to 1801 (when Adams in England wrote of "the carcinomatous hydatid"), both vegetable and animal parasites have been brought up, among them Schüller's "golden-yellow organisms," which instead of being the cause of both sarcomas and carcinomas, turned out to be cork-cells from the material in which specimens were mounted. However, the transmissible tumors of birds

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(9) Jour. of Cancer Research, July, 1919.
(1) Railway Surg. Jour., April, May, 1919.

and animals referred to several times in the Surgery volume, afford considerable evidence of this hypothesis.

There is a full account of "cancer-areas" and "cancer-houses"; also of heredity, which is not believed to be very potent, in view of the wide spread of the disease, very few families being without this affection in near or distant relatives.

The older authors supposed cancer was the local manifestation of a constitutional disease, and proposed to treat it by systemic measures, *e. g.*, mercury (Boerhaave), hemlock (Storck), venesection (Broussais). Late in the 19th century, several writers thought there was some relation to malaria, both being prevalent in marshy ground or wet places implying some parasite carried by water. In fact it was even proposed to treat by injections of blood from persons with malaria. Of late, it seems to be established firmly that an attack of malaria has no modifying effect on malignant growths.

Rheumatism, and tuberculosis have also been supposed to have some effect in starting up malignant disease. Syphilis as well, a French author in the middle of last century advocating inoculation with syphilis! De Pury's paper (1919 volume, p. 181), which strongly affirms the causal effect of syphilis, is also quoted at length.

Other bizarre causes are alleged tendency to affect first-born child principally, thyroid overwork, contagion from the discharges, high temperature of food and drinks, drinking unboiled and hard water, which hardens the lining of the alimentary canal, and causes cancer if radium lodges in this hard lining.

The large subject of diet is gone into at considerable length, too great flesh diet, use of pork, low potash content of food, excess of salt, and so on. Also alcohol. Though at the Galton Institute (London) Heron found cancer less common among inebriates.

Pennington states in conclusion:

> Such are a few of the many theories to account for this fell disease. Some are absurd, others ridiculous; more than one are diametrically opposed to each other, yet several seem to contain a figment of truth. Some facts can be found to substantiate the parasitic theory, others as the famous "Kangri burns" of Kash-

mir, seem to negative it. This leads me to ask if there is only one cause after all. As Rohdenburg and Bullock observe, the wide distribution of cancers in Nature speaks for the possibility they are dependent on general biologic phenomena, as opposed to some specific causal agent.

Cancers have been found in the warm-blooded animals and birds, in the cold-blooded reptiles, amphibians and fishes, and—according to Bashford—even the lowly oyster has been found to harbor a tumor. I believe it is evident that the same cause for malignant tumors in man must also hold good for similar growths in other vertebrates.

Of late years the typical example of *cancer from irritation* has been the Kashmir *Kangri* (or fire-basket) worn under the clothing. To this G. F. King[2] adds the Chinese custom of sleeping on top of the *kang* (or oven). He writes it is almost possible to pick out inhabitants of the province of Kansu by the pigmented patch over each trochanter which so often develops into an epitheliomatous ulcer.

An example of *cancer following a sulphuric acid burn* is narrated by D. R. Mishell.[3] An employe of a dye factory, aged 57, some 7 months prior had a few drops fall on dorsum. This left a small ulcerated surface about the size of a pea which gave little pain, but refused to heal. Three months later he noticed an increase both in diameter and height. Growth continued for the next 4 months. The mass about 1½ in. wide and ¾ in. high, had a reddish, ulcerated surface and a distinct red border. In the center, was a sinus from which a slight yellow discharge exuded. Pain confined to periphery, had been continuous for a few months, increasing day by day. The axillary nodes were not palpable at the time.

The mass was excised, healing was slow but in 6 weeks, the area started to fill in with healthy granulation tissue which slowly obliterated the excavated area. A microscopic examination revealed an actively growing squamous cell carcinoma. When seen subsequently, the hand had almost entirely healed, but a hard mass, about size of a hen's egg, was protruding from the axilla. This had started 3 months after the original tumor

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(2) China Med. Jour. (quoted in Jour. Amer. Med. Ass'n, July 5, 1919).

(3) Jour. Amer. Med. Ass'n, Dec. 27, 1919.

had been removed, and had rapidly progressed during past 5 weeks. Sent to hospital for treatment.

Tumors in Animals. A *mammary carcinoma in the cat* is described by S. Itami.[4] It was in the r. axillary mamma, hard, nodular, and .4×1.2×.8 in., containing a few small cysts, and adherent to the skin which, toward the lower pole, presented 2 ulcers involving the lowermost axillary nipple. These resembled cancerous ulcers in the human subject, their edges being raised and scalloped and the floor formed of firm granulation tissue discharging a foul ichor. Toward the upper pole, the tumor grew narrow, passing by the upper nipple and extending into the r. axilla where it broke up into a string of separate nodules each about the size of a pea.

At necropsy it was found the growth was not adherent to the musculature. The axillary nodes, as well as the supracondylar and one in the neighboring connective tissue, were enlarged. The lungs contained a few shot-sized nodules, these being more prevalent in the middle lobe of r. lung, which contained 6. The corresponding mamma on the opposite side, which did not show any macroscopic changes, was examined microscopically to see whether changes like those described by Haaland could be discovered. A coexisting pregnancy naturally obscured somewhat the conditions present in the organ, but there could be no doubt it was the seat of an extensive papillary cystadenomatous change, or that certain regions were carcinomatous; whether these areas represented new tumors, however, or metastases from that in the other breast, could not be decided.

[Such growths in the lower animals show, as Pennington points out, that the same causes must be operative as in human beings.—Ed.]

M. Cadiot[5] professor of pathology at the French veterinary school (Alfort), treats of *cancer of the tongue and lips in animals*. During the latter half of the last century, these were thought to be common, but with discovery and separation of actinomycosis, botromycosis, and other morbid processes with hypertrophic or ulcerative lesions, they are found to be very rare.

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(4) Jour. of Cancer Research, January, 1919.
(5) Bull. Acad. de Méd., Feb. 25, 1919.

Cancer of the lips is extremely uncommon in all species of animals. They are seen at infrequent intervals in the dog, in aged individuals, generally on the lower lip. In this animal also, we meet exceptionally with secondary labial neoplasms, due to accidental grafting by licking or biting ulcerated growths elsewhere, with repeated friction of the lips against them. In the horse, they are still more rare, in spite of the continual irritation of the bit and the reins on the free borders of the lips and the frequent traumatic lesions of the commissures. Cats have a condition erroneously termed "cancroid," this is not an epithelioma but an ulcer due to microbes, and somewhat easily cured without operation. Nothing is on record as to labial tumors in other domestic animals.

Cancer of the tongue seems equally uncommon, Cadiot has been able to find but 7 cases—horse, 3; ox, 1; dog, 1; cat, 2. One horse was 18 years old; another seen by Cadiot, was 15. He points out that in this species, the cancer starts where the mucosa is rich in fungiform papillæ, so far it has not been found in the middle of the organ, and especially at the free end which is most exposed to traumatic irritation. In the ox, there is but one case known, a squamous-cell tumor with epithelial "pearls." Among carnivora up to the beginning of the century, the only example in the cat was one met with by MacFadyean, the English veterinarian. The animal was 12 years old, and the whole thickness of the organ at the middle was invaded by an epithelioma which had started on the lower surface, near the frenum. Since then another case has been found also in England. A truly extraordinary circumstance, Cadiot continues, is that up to 1909, no case in the dog had been reported. In that year one was recorded from Russia, in an animal of 9 years, with multiple growths. Three small tumors on skin of abdomen, an ulcerated growth the size of an acorn on the right side of lower lip, and 3 small tumors on the pharyngeal mucosa. The base of the tongue was occupied by a mass which proved to be an "epithelial cancer."

[Tumors are equally rare in wild animals. Several years ago (1908 volume, p. 110), Brooks stated of 2647 mammals but a single case developed, a myxosarcoma of ovary.—Ed.]

Association with Tuberculosis. Some 20 examples are detailed by A. C. Broders[6] from the Mayo Clinic: There were 14 males, 6 females; the average age was 49, youngest 20, oldest 77. In 7 patients the tumor was on lip, in 3 on cheek, in 2 each breast and near angle of jaw, rest scattered. Six could not be traced; 4 died, 3 with malignant metastases in cervical nodes. Two of the 10 living patients have a recurrence of malignancy, 3 are in good health, and 5 operated on too recently to be considered. Of the three in good health, 160 months, 91 and 39 months, respectively, after their last operations, the latter 2 had epithelioma and tuberculosis in the nodes of neck.

Broders suggests the reason pathologists are not finding tuberculosis more frequently in persons who have died with malignant neoplasia is they are satisfied to find the malignant condition, and therefore fail to make a thorough search for tuberculosis. Since the surgical pathologist's examination is limited to the tissue removed by the surgeon, he is greatly handicapped in the search for the 2 conditions associated, while the pathologist doing a necropsy has access to a large part or the whole of the body. The fact that active tuberculosis occurs most frequently under 45, and malignant neoplasia, especially epithelial tissue neoplasia, most frequently over 45, does not prohibit the association of latent and healed tuberculosis with malignant neoplasia. In his series the two conditions were associated in the same microscopic field 7 times.

Basal-cell Growths. Of 2,000 cases of *general epithelioma* at the Mayo Clinic, 268 (13.4%) were of this type, and are also dwelt on by Broders.[7]

They occurred in 165 males, and 103 females. The average age was 56.7 years, youngest 23, oldest 87. Of the males, 56.16% were farmers, and of the females, 43.33% farm workers. There was a history of previous mole, wart, ulcer, etc., in 37.1%, while a history of injury was had in 9.3. The average duration was $7\frac{1}{12}$

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(6) Jour. Amer. Med. Ass'n, Feb. 8, 1919.

(7) Ibid., March 22, 1919.

years, with extremes of 3 months and 45 years. Only 16 patients had multiple lesions.

Nearly one-half were treated with a single excision, and 26.86% more by excision followed immediately by the cautery. Of 145 patients heard from, 35 died, with a mean survival after the last or only operation, of 4 years, 3.6 months. In the 110 still living, 5 had no improvement, 22 slight recurrence, and 83 none. The time since operation in the last class varied from 1 year or more, up to 13 years or more, with an average of 6 years, 1.6 months. As the cases tabulated came to the Clinic between Nov. 1, 1904, and July 22, 1915, which period antedates the active use of radium in this type of neoplasm, practically no account is given of their experience with its curative properties.

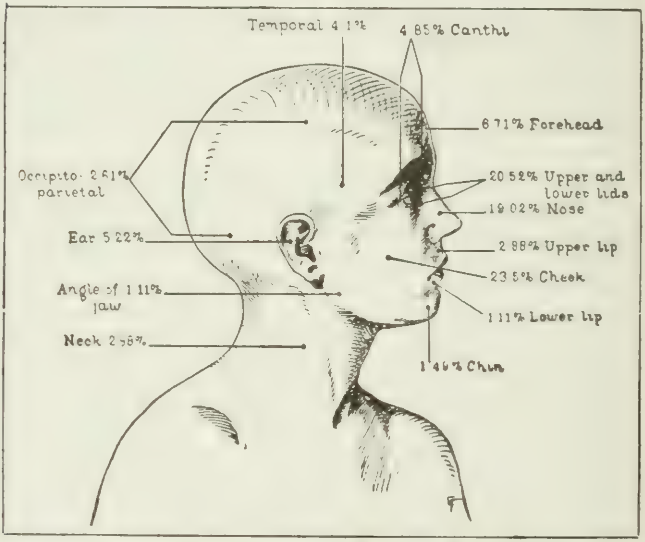

Fig. 33. Location and per cent. of basal-cell epitheliomas above clavicle (Broders).

Metastases. In 3,700 necropsies (at Amsterdam), W. M. de Vries[8] found 518 cancers, and compares his find-

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(8) Tijd. v. Geneesk. (quoted in Jour. Amer. Med. Ass'n, July 19, 1919).

ings as regards metastases with former ones: The liver cancers entailed metastasis in a surprisingly large- and lung cancers in a surprisingly small proportion. The metastatic nodules are also at correspondingly opposite extremes in size with lung and liver cancers. He was impressed further with the frequency in bones, 53 of the 518 cases, and the whole of the skeleton was not examined so others may have escaped detection. In some cases there were multiple metastases in the skeleton, suggesting a blood-borne origin. Metastasis there was noted in 7 of the 19 mammary- and in 5 of the 19 prostate cancers. There were only 2 thyroid cancers, but in one of these there was metastasis in the skeleton. The metastases develop readily also in the adrenals and ovaries, but not in the spleen, heart and muscles. In 69 cancers in the esophagus, metastasis occurred in the liver in 26%, the larger proportion with low seated cancer. The longer survival with the latter may explain this. Mechanical factors alone are unable to explain metastasis, especially the preference for certain organs, nor size of the cancer cells.

Cancer cells probably circulate freely in the blood but die off readily. Chemical factors may aid in their destruction in certain organs in which metastasis seems to occur rarely. This suggests the possibility of treating cancer with extracts of these organs. Attempts in this line with spleen tissue and extract have given negative results as far as he knows. In Kaufmann's 1,078 cases of cancer (Basel) there was metastasis in the spleen in 8; in these the primary lesion was in the uterus, penis, thyroid, kidney, gallbladder or stomach. In Mielecki's 487 cases the frequency in the skeleton with mammary and prostate cancer was as marked as in De Vries' cases (8 in 18 and 11 in 30). Comparison with other statistics confirms the greater prevalence of primary cancer of the thyroid in Switzerland, and of the lungs at Berlin, but with all the statistics the percentage of organs affected with metastasis is proportionately about the same. The fact it is so rare with cancers in the larynx and upper esophagus may be explained by the comparatively early fatal termination. The exemption of the muscles, of the brain from metastasis with gastric cancer (no signs in the brain in Kaufmann's 227 gastric cancers and only in 1 of Mielecki's 156 cases), and the predilection of the liver, skeleton and adrenals are insoluble mysteries at present.

[In the 1916 volume (p. 167), the late J. B. Murphy in an editorial note, gives statistics of 10,310 cancers, with and without metastases. (See also 1918 volume, p. 178.)—Ed.]

Diagnosis. *Sugar tolerance in cancer,* which may ultimately prove of diagnostic value, is dwelt on by Rohdenburg, Bernhard and Krehbiel.[9] Not a few investigators have attributed cancer development to faulty function of the endocrine glands. There are no specific lesions demonstrable in those of mice with spontaneous tumors nor does extirpation or the feeding of one or more of these glands have any apparent influence on the rate of growth, infectivity, or immunity against animal tumors. Nevertheless, there may be derangement of endocrine function not demonstrable by histologic or surgical technic. The functional activity of some of the endocrine glands can, to some extent, be measured by the sugar tolerance test first brought into clinical use in 1913. In the morning, after a night's fast, the individual is given either 100 gm. of anhydrous or 115 gm. of syrup glucose dissolved in 300 c.c. of tea or coffee without milk or sugar, care being taken that the glucose is all dissolved and the patient takes the entire amount. Just before giving the glucose, and again 45 and 120 min. after its ingestion, blood is withdrawn and the amount of sugar in it is determined. At the same time periods the urine is qualitatively examined for sugar.

The cancer curve in contrast to the curve observed in other diseases starts with a normal blood sugar, 100 mg. per hundred c.c. of blood; rapidly rises so 45 min. after the ingestion of glucose 180 or even 200 mg. per hundred c.c. are present, and 120 min. after the glucose is ingested the blood sugar is either as high as at 45 min. or higher, reaching 288 mg., and in one instance 350 mg. per hundred c.c. of blood. The percentage of blood sugar gradually falls and approximates normal in 3 to 4 hours after ingestion. The average of 4 curves in which

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(9) Jour. Amer. Med. Ass'n, May 24, 1919.

specimens of blood were taken up to three hours is shown in chart. This curve was present in their limited experience in 24 cases of carcinoma and 1 of sarcoma and does not occur in some 40 other diseases examined. The curve covering epinephrin instead of glucose is identical with that following ingestion of glucose. The sugar tolerance bears no relation to the location of the tumor.

To the "57 varieties" of *early diagnosis of cancer,* J. Regnault[1] adds the electrotonic reactions of the visceral reflexes. Of late years the researches of physicists have led them to the theory of electrons which has facilitated studies in physics and chemistry, and thrown new light on biologic sciences in general, and medicine in particular. Everything in Nature is but vibrations. Some of these (*e. g.,* light), are perceptible to our senses, because we possess organs which are syntonized to the lengths of their waves and related to parts of the brain which recognize them. There are other vibrations which are capable of detection only by physical or chemical reactions, among these are Hertzian waves used in wireless telegraphy, and the ultraviolet rays known by their effect on photographic plates. But there are many others which escape study because we have no means for their

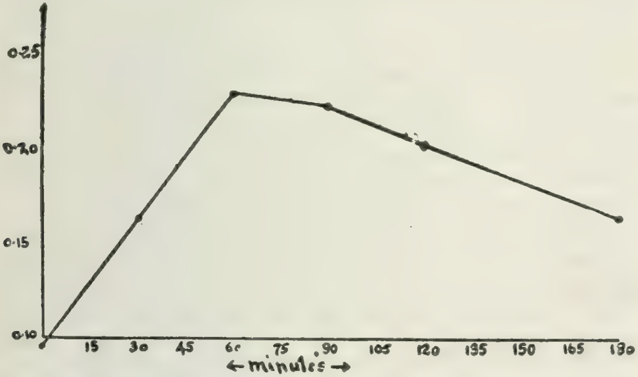

Fig. 34. Cancer curve based on 4 cases. Sugar per cent. per 100 c.c. of blood (Rohdenburg, Bernhard-Krehbiel).

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(1) Presse Méd., Oct. 11, 1919.

detection. However, thanks to the great sensibility of the visceral reflexes, a good many of these vibrations may be discovered.

All matter which gives off electrons, every functionating organism, is surrounded by an electrotonic field. Cancer, proliferating actively, is surrounded by a powerful electrotonic field, which has particular characters of polarity, of intensity and of syntonization in relation to a rheostat, also in relation to the patient or to a healthy individual on whom this electrotonic influence acts.

We may also estimate the malignancy of a growth and map out the extent of its invasion; we may under such conditions, diagnose cancer from its inception and operate under the best conditions. Finally, studies in progress on the polarity and especially on syntonization of the cancerous energy enable us to hope there is a possibility of restricting or destroying the malignity of the tumor before operation.

The vexed subject of *diagnostic incision of tumors* is touched on again by F. C. Wood.[2] It seemed ideal for attack from the experimental side, and the Flexner-Jobling rat carcinoma employed is an adenocarcinoma, which frequently metastasizes to the lungs, vessels and regional nodes. The inoculated tumors tend to remain discrete when a small graft is placed in the loose subcutaneous tissue of the side, and clean incision does not cause local spreading in the tissue planes. In suitable animals, the tumors take in a large percentage and grow progressively. A total of 673 rats were inoculated, and divided into three groups.

The results may be thus summarized: The average percentage of metastases in Group 1 (probatory excision), was 22.2. The average percentage in Group 2, (tumors removed without previous incision) was 21.8 In the animals in Group 3, without any operative procedure, the percentage was 32.2. These figures include metastases in the lungs and in the lymph-nodes. Series 3 shows the frequency of metastasis is a function of the time the tumor remains in the body, and again emphasizes the well known fact that a malignant tumor should be removed as soon as possible after diagnosis.

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(2) Jour. Amer. Med. Ass'n, Sept. 6, 1919.

A similar experiment with the Crocker Fund rat sarcoma No. 10 on 384 animals also showed no increase in metastasis as a result of the incision of the tumor.

It is evident, adds Wood, this experiment demonstrates that in white rats bearing the Flexner-Jobling carcinoma, or the sarcoma No. 10, metastasis is not increased when the tumor is incised, a fragment removed aseptically, and the growth allowed to remain in the animal for 10 to 12 days thereafter. It permits the deduction, also, that human tumors are probably not widely distributed by incision, as has been thought, and therefore, when these tumors are situated where a mutilating or highly dangerous operation is necessary, they should be examined microscopically *if a diagnosis can be made in no other way.* It is preferable such diagnosis be made immediately by frozen section, if facilities are available, so if necessary the operation can be continued under the same anesthesia; but the future is not necessarily compromised if a small fragment is removed, the wound closed, and the operation proceeded with the moment a microscopic diagnosis is obtained. With modern rapid methods of preparation of sections, the lapse of time need not be more than 3 or 4 days.

[The theory developed in this article is extremely dangerous because the observations made upon a healthy rat are applied to a sick human being, and the important fact that there is a tremendous difference between the liability of cancer in different individuals is entirely lost sight of.

The occurrence of cases in our personal experience of patients who have died of metastatic cancer after the removal of a small piece for microscopic examination, is so common that we have come to look upon this practice as absolute malpractice. It is to be remembered that this occurs in cases in which the original tumor is not advanced, because in advanced cases no one can feel the necessity of excising a piece for microscopic examination; consequently it is likely that all of these patients' lives could have been saved had an extensive excision been made, instead of following the advice in this article.

It seems important to advise most emphatically against this dangerous teaching.—Ed.]

[See also 1918 volume,—p. 175.—Ed.]

Prophylaxis. The *practical principles for protection against cancer*, are enumerated by A. J. Ochsner.[3]

The importance of the subject is urged because in the U. S. reliable statistics show that annually approximately 100,000 persons die of cancer, a number twice as great as the entire number of Americans who died of wounds during the War. During the next 10 years a million of the present inhabitants of the U. S. will have died of cancer unless we are able to introduce practical principles of protection.

Statistics have been investigated which seem to show that cancer of the stomach and intestines causes a high mortality in people eating an abundance of vegetables which have been fertilized with human excrement, while in the same people skin cancer may be exceedingly rare provided the people are scrupulously clean and vice versa. The importance of preventing chronic irritation from mechanical, chemical, thermal causes, from old scars and from *x*-ray is emphasized.

In considering the subject of contagiousness or infectiousness of cancer, the similarity of the arguments employed before the last quarter of the last century to prove that tuberculosis and leprosy are non-contagious and non-infectious, and the arguments which are employed at the present time to prove that cancer is non-contagious and non-infectious is pointed out.

A warning is given against committing the ancient logical fallacy according to which the absence of conclusive proof is sufficient to disprove a fact.

Racial differences as to frequency of cancer are explained by differences in cleanliness in food and person.

Heredity is difficult to analyze because parents and offspring live under identical conditions as to hygiene, nutrition and cleanliness.

Judging from a study of statistics and reports of scientific studies, and from personal observations, the following conclusions seem warranted:

1. The medical profession and the public must be taught that cancer is primarily a local condition.

2. Unless recognized and removed early it is usually fatal.

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(3) Illinois Med. Jour., November, 1919.

3. A careful examination should invariably be made the moment cancer is suspected.

4. If uncertain about a diagnosis, a consultant with wider experience should be sought at once.

5. During the cancer age, which is, generally speaking, over 40, in case of doubt the tumor should be removed immediately and thoroughly.

6. Inoperable cancer should be removed only with the distinct understanding by the friends that the operation is palliative for the purpose of reducing suffering.

7. Violent manipulation for diagnosis and treatment must be avoided.

8. All sources of chronic irritation of tissues must be eliminated.

9. Cleanliness of the skin must be taught and practiced.

10. All articles of food which have come in contact with manure or human excrement in the form of fertilizer must be boiled before eating.

11. Sewage must be disposed of so as not to contaminate human food or water.

Treatment. The arguments of I. Levin in favor of *x-ray treatment* were set forth in the 1917 volume (p. 178). In a recent article[4] he recurs to this aspect. He undertook a comparative analysis between vital statistics and the surgical statics of cancer, based in the U. S. census figures for 1900.

His analysis shows that as a high estimate 15.25 and as a low 4.15 per cent. of all cancer cases can be cured by surgical treatment. Even on the supposition of the unattainable ideal, that instead of 50 per cent. all the cancer patients should come in the operable state, and all the surgeons should possess extreme skill, not more than about 30 per cent. of all the cancer cases could be cured by surgery. At present rather less than 10 per cent. of all cases are cured. It is safe to assume there can hardly be expected much further progress in surgical treatment of malignant tumors. The latter are usually situated in close proximity to the vital organs, the injury of which would endanger life, consequently there is a limit set to the length to which a

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(4) Med. Record, April 5, 1919.

surgeon may go in removing the normal tissue adjacent to the tumor. As a result of these limitations there may remain small islands of cancer cells in or near the field, even after a radical operation on a favorable operable case. Or, the knife may inadvertently cut into such an island and throw freed cells into the opened lymph and blood channels; the tumor will then recur in the same region or in a distant organ.

The second reason for the failure of radical operation and the subsequent metastasis formation in some distant organ is that even in the early operable stage there may be present minute nodules in the distant organs which cannot be detected by any diagnostic means at our command, but which after the operation develop into large metastatic tumors.

G. E. Pfahler[5] discusses *treatment of malignant disease by electrocoagulation.* This differs from the thermocautery in that the heat is generated in the tissues and is produced by the resistance to the flow of the electricity through the tissues, while the thermocautery destroys by transmitted heat and necessarily produces a more superficial effect. The effect of electrocoagulation can be thoroughly controlled by varying the relative sizes of the electrodes, so one can make the conductive heat approximate a cone or cylinder. When one of the electrodes is a point, and the other a flat surface, the greatest amount of destruction will develop at the point, and then will radiate more or less coneshaped toward the opposite electrode, thereby in the distal area giving a zone in which the tissues are heated to the destructive degree for malignancy, but in which healthy tissues will not be destroyed.

Suitable cases are: 1. Those where the disease can be destroyed completely, locally, without regard to saving vessels or nerves, for in this coagulation process the vessels and nerves are destroyed in the same manner as the diseased tissue. It is, therefore, applicable to lip cases, epitheliomas on the inside of cheek, the tongue, the floor of mouth, and the alveolar process, but is not suitable for use on the metastatic nodes of neck. 2. Those cases in which one can combine the

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(5) Pennsylvania Med. Jour., February, 1919.

local destruction of the disease in the mouth with the surgical removal of the diseased nodes in the neck. 3. It is of doubtful utility in sarcomas.

Advantages of Electrothermic Coagulation.—1. The disease is destroyed by conductive heat which gives a zone of devitalization without actual destruction of healthy tissue, thereby saving local tissue when necessary. 2. No fresh bleeding wounds in which to permit the transplantation of malignant cells. 3. No blood or lymph vessels opened up through which the disease can be disseminated during the operation. 4. One does not have hemorrhage to contend with, though in tongue cases there is some danger of secondary hemorrhage. *Disadvantages.*—1. There is complete destruction of all tissue between the electrodes; therefore, no chance of saving vessels or nerves in close proximity to the disease. 2. There is necessarily considerable sloughing and foul odor associated during the first few weeks, but there is no danger of infection, and odor can be diminished by dichloramin-T. There is considerable local reaction during the first few days. 3. It leaves an open area which is healed by granulation, but at times this healing must be followed by a plastic operation to close the mouth or some open space, or correct some deformity. It is remarkable how a very ugly wound in the early stages will close in and develop rounded edges so as to become very insignificant.

For *treatment of early and doubtful cases of cancer,* R. B. Greenough[6] advises that the radical operation must be performed earlier than at present if material improvement in the results is to be attained.

The diagnosis of early cases cannot always be made by the typical clinical symptoms, and must be, to some extent, dependent upon exploratory operation and immediate frozen section examination of the tissue. The removal of tissue for diagnosis must be done so as not to cause local implantation or spread of the disease and thus imperil the chances of cure by radical operation.

Operations for radical cure in different situations have been standardized. Those for exploration of suspicious but doubtful cases in different situations may

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(6) Boston Med. and Surg. Jour., Aug. 21, 1919.

also be standardized. For this purpose 3 groups may be recognized. (1) Small and early ulcerative lesions of the skin and superficial tissues and the marginal mucosæ: Lip, tongue, mouth, vulva, vagina, uterus and rectum. Such lesions should be excised with a broad margin of healthy tissue and subjected at once to frozen section examination. If cancer is demonstrated, the radical operation completed at once under the same anesthesia. In doubtful lesions, large and ulcerated, a fragment may be removed with the electric cautery from the central portion, but only when absolutely necessary. (2) Carcinoma of breast, sarcoma and carcinoma and other non-ulcerative malignant tumors of the deeper tissues. The cautery should be used in preference to the knife for exploration and excision of tissue for immediate examination. The radical operation performed at once, under the same anesthesia, if cancer is present. Delay in waiting 7 to 10 days for a pathologist's report is likely to be fatal to the chances for a radical cure. (3) Carcinoma of the stomach, colon, gallbladder, kidney, prostate, ovary and testicle. In these situations no exploratory incision into cancer tissue is necessary or advisable. The radical operation will be performed in any case.

"Pre-cancerous" lesions, not yet showing evidence of malignancy, should be removed by the knife in preference to radiation or the cautery, and the tissues subjected to examination.

An investigation of the *power of mesodermal derivatives to immunize* against transplantable tumors was undertaken by S. Itami.[8] In mice representatives of all 3 germ layers have the power to confer resistance, with the exception of one ectodermal derivative, *i.e.*, the crystalline lens. The failure of mouse lens to produce immunity in the experiment of Uhlenhuth and Weidanz is an interesting phenomenon in view of the constancy with most other tissues. Itami repeated the trials in rats, but not the slightest indication of immunity could be discovered in any of the experiments. He remarks preliminary treatment with normal tissues containing but few cells, whether of ecto- or mesodermal origin, fails

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(8) Jour. of Cancer Research, January, 1919.

to induce immunity to transplantable carcinomata. Muscle, also, though this is more cellular, is inactive, for some reason at present unknown. Lymph-node, on the contrary, elicits a high resistance.

Sarcoma in Children. A case *in a girl-baby, of 16 months,* was met with by H. B. Mills.[1] There was a history of sickness only a fortnight previous, and death occurred 15 days after admission. The sella turcica was shown by the *x*-ray to be obliterated by the growth, which proved on examination to be round-celled.

[Another example of the tendency of sarcomata to attack children and young adults in distinction to the age-incidence of carcinoma, is the one involving the ovary in a child, of 23 months, recorded in the Gynecology volume for 1919, edited by Prof. Dudley.—Ed.]

THE BLOOD VESSELS.

On Jan. 22, 1908, C. C. Guthrie divided the right common carotid of a young, adult dog, and a *segment of vena cava,* preserved 60 days in formaldehyd solution, was interposed and sutured to the ends. The implanted tissue was treated with ammonia and absolute alcohol, and impregnated with petrolatum, just prior to the operation. Feb. 12, the artery was exposed, and a direct examination revealed an active circulation through the segment. The animal died of age on March 20, 1919, and an account is given[3] of the findings:

There was an enlargement of the right common carotid artery about 1.4 in. long and .8 in. in diameter on the course of the artery near the root of the neck, distal to the origin of the artery. Above and below, the artery appeared and felt normal. The enlargement was fibrous and vascularized on the surface, and to the touch was resistant, but springy and apparently hollow. A connection through the mass between the parts of the artery on each side was demonstrated by manipulation under liquid, and confirmed by section. This experiment was undertaken to obtain conclusive evidence as to whether devitalized tissue may serve adequately and indefinitely

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(1) New York Med. Jour., April 5, 1919.
(3) Jour. Amer. Med. Ass'n, July 19, 1919.

to transmit blood in vascular restitution. It is the first of the kind, as well as the longest in end-results.

Aneurism. *The transformation of arteriovenous—into true arterial aneurisms* has been studied by L. Chevrier.[4] This is denied by the classic texts; also that they heal spontaneously and that they contain clots. He had 4 cases under observation, one was completely cured spontaneously, another was on the way to cure also spontaneously, two were operated on:

I. Clots were discovered. Evidently these clots will not be found in the direct communications, a large sac is necessary for their formation. Possibly also they are only formed in the diffuse types such as this case. Finally, they may possibly form only in the diffuse aneurisms in which the circulation in the sac is poor, or the lesion in the artery is someway off from that in the vein, and not in the trunk proper but on a branch. The presence of clots in this case was confirmed by the occurrence of pulmonary embolism (non-fatal). A clot may mechanically obliterate the opening in the vein and transform the arteriovenous—into an arterial aneurism. This transformation may be only temporary if the clot is not adherent and later displaced. When the clot be-

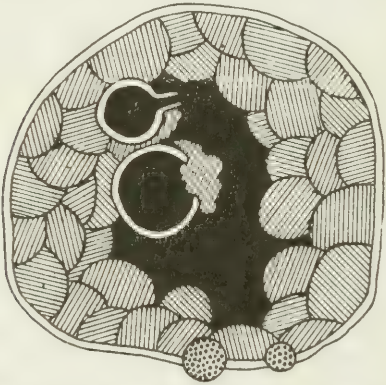

Fig. 35. Arteriovenous aneurism with clots—schematic (Chevrier).

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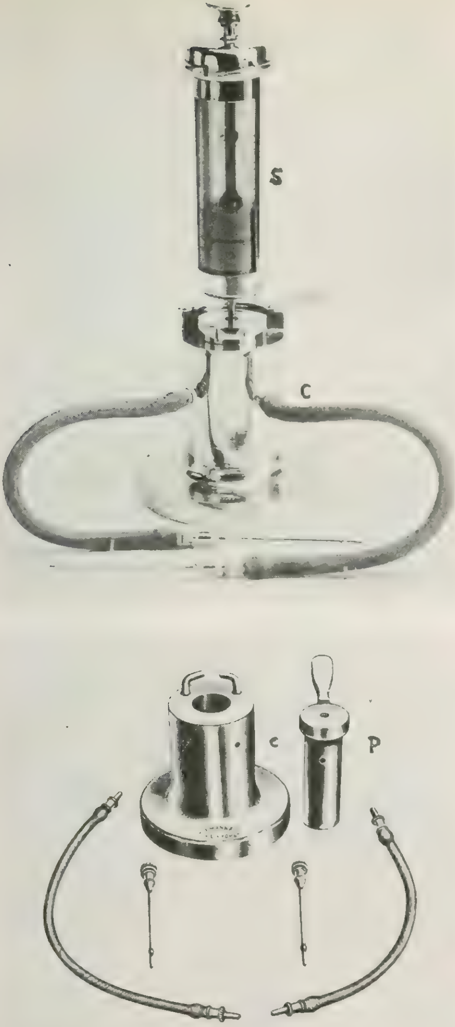
(4) Presse Méd., Dec. 18, 1918.

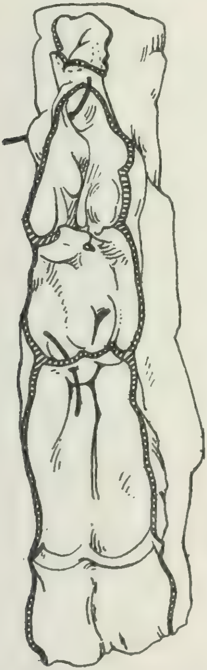
PLATE II.



New transfusion apparatus—Wight. (See p. 165.)

comes adherent and slowly organizes, the transformation is permanent. Such transformation, however, is to be considered as an aggravation, in fact, the sac rapidly increased in size and was on the way to speedy rupture at the time of operation.

II. In this case, at the operation, the vein was found to contain 3 diaphragms composed of valves—one completely occluding the lumen below the orifice into the artery, 2 others were incomplete, the third pair of valves was supple and non-adherent. Then blood escaping into the vein through the hole from the artery could not pass into the central end, it could only descend in the peripheral end having to traverse 2 stenoses formed



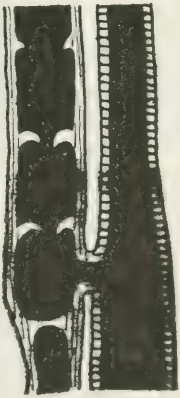


Fig. 36. Wall of vein showing hypertrophic and adhesive valvulitis.

Fig. 37. Section of vein and artery showing segmentation of venous column (Chevrier).

by the retracted valves. This method of transformation due to endophlebitis with hypertrophic and adhesive valvulitis seems to be new. It was not accompanied by any aggravation of the aneurism itself. It may be supposed that in time, this process of transformation would have led to cure by occlusion of the perforated diaphragms, then the arteriovenous aneurism would have become an arterial one, the sac endovenous.

In order not to change the terminology, Chevrier believes it better to state that there may be recent and old arteriovenous aneurisms. The recent type may change into arterial aneurisms by various mechanisms, particularly by the existence of a passive clot, possible under certain conditions; at first this is simply occlusive, later on adhesive. In older types, there is necessary the partial—and possibly total endophlebitis with hypertrophic and adhesive valvulitis.

For *treatment of aneurismal varix,* W. Pearson[5] has employed what he calls "transvenous aneurismorrhaphy" with most gratifying results. A soldier was wounded Oct. 1, and operation done Jan. 15. The popliteal vessels were exposed in the upper part where the artery and vein were firmly adherent to one another without any intervening sac. Here the vein was greatly dilated and the artery below was considerably smaller than usual. When freeing the side of the vein remote from its connection with the artery a saccular venous aneurism was exposed and was removed, disclosing the stoma through the lumen of the vein. It was of elongated elliptical form, ⅓ in. long, and lying in the long axis of the vessel. The opening in the vein was enlarged very slightly up and down, and through it the opening was sutured with fine silk sterilized in liquid paraffin. The vein was then closed in a similar manner. On removal of the tourniquet there was no bleeding and the circulation seemed perfect. After operation good pulsation was felt in d. pedis and post. tibial. Healing was uneventful, the circulation remained good, and the patient allowed to walk 4 weeks after operation. In 2 months was discharged to light duty, the circulation being normal. Until massage was instituted, 3 months after wound,

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(5) British Med. Jour., June 14, 1919.

the patient exhibited no signs of aneurism, although there were evidences of venous obstructions from the beginning.

Apart from rigid asepsis, scrupulous care must be exercised to avoid injury to the delicate intima of the vein. Consequently any blood which may obscure the view must be washed away by gentle irrigation with saline, which is then carefully mopped up by a gauze swab or aspirated by a syringe. On no account must a swab be introduced into the vein for *wiping* off blood; such a measure will favour subsequent thrombosis. The vessel wall should be smeared with sterilized vaseline.

The needle is first passed through a small portion of the fibrous tissue which binds the vessels together at one end of the communication, on its external aspect (*i.e.*, entirely outside the vessels and between the two), and does not penetrate the intima of either—it thus resembles the commencement of the outer row of sutures in a gastrojejunostomy. This stitch is immediately tied and the needle then passed obliquely from without in, emerging on the inner surface of vein close to the extremity of stoma. The extreme edges of this are then brought together by fine continuous sutures through intima and media until the opposite end is reached, when the needle is again passed out from the lumen of the vein obliquely through its wall and the overlying tissue which binds it to the artery, so as to emerge between the two, when it is secured in a similar manner to the other end. Thus there is no knot in the lumen of either vessel, and if the stitches are placed accurately and drawn taut throughout they do not present in the lumen of either vessel any more than in ordinary through-and-through stitches which produce eversion of the edges in vascular suture. The closure of the incision in the vein presents no difficulty, being effected by the Carrel method.

Varicose Veins. Brilliant green, the anilin dye, has been referred to as an antiseptic (*e.g.*, 1918 volume—pp. 90, 92; 1919—p. 88). G. P. Coopernail,[6] however, advises it *for marking out varicose veins* before operation. They should be mapped out with an aqueous solution the day previous and let dry before the clothing touches

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(6) Surg., Gynecol. and Obstet., October, 1919.

them. And at the time of operation they can be painted with one or two coats of iodin. The vessels will show beautifully through the iodin, as green intensifies almost all colors. After the skin has been marked with the green, it is almost impossible to wash it off with alcohol, turpentine, ether, etc. It takes several weeks to wear off. There are a number of distinct advantages in marking out the veins. We can readily locate all the vessels and save much time searching for them. It enables one to perform a more thorough operation, removing all enlarged vessels. When marked out it is possible to follow them with parallel incision, which will give better access to adherent and tortuous vessels. Following the parallel incision there will be less scar. Most operators make the transverse incision to locate the vessels more readily. (It has also been suggested it would be a good way for marking the scalp in intracranial operations.)

Fig. 38. Extractor for varicose veins. Wire with one end (*A*) beaded, the other (*B*) fitted with base of cartridge (Tamisiea).

[See also Pusey's method—Operative Technic.—Ed.]

Babcock's *extractor for varicose veins* was described and figured in the 1911 volume (p. 581). One quite similar was improvised in France by J. A. Tamisiea.[7] Silver wire such as used for bones, 40 in. long, had attached to one end the base of a rifle cartridge. He first filed the sides off and then bored the cap off and ran the silver through the hole and secured it with solder. This wire had to be quite pliable, but not too much so. The other end was beaded over a Bunsen burner. He would put a tourniquet on the thigh and pick up the int. or ext. saphenous as the case happened to be, and then make incision over it about 1 in. long, pick up the vein with hemostats, and tie off the lower end of it (distal end). Then pick up the vein in the thigh by the same incision and tie off the upper end (proximal end). To open the vein up well he applied the hemostats to the edges and

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(7) Jour. Amer. Med. Ass'n, Aug. 16, 1919.

held them open while he inserted wire. Then gently pushed the wire up and followed its course with hand on the leg. This was usually done from the bottom, as in the pulling up on the wire one would take all the minor tributaries as well as the main vein. When the head appeared at the higher incision Tamisiea would grasp it well and have an assistant hold the foot firmly, and pull hard until wire was entirely out and then would have the vein gathered up on the wire in its entirety. Very little if any hemorrhage resulted. A stitch was then put in each incision and an alcohol dressing over it.

TRANSFUSION.

Technic. Introducing a *new transfusion apparatus*, J. S. Wight[8] remarks a transfusion set should be simple and foolproof. In his instrument, the canulæ are provided with a small set-off near the end so they cannot slip out; they are connected to the instrument with rubber tubes, No. 17 F. There is a heavy metal cylinder *C*, and a metal piston *P*, fitted with a collar and handle. The former has 2 tapered holes in wall to receive the tubes to canulæ and 2 pieces of metal on top for guides to handle of piston. This latter also has a tapered hole at top to fit syringe, and this hole meets another in side at r. angles, on the same level with holes in cylinder when piston is in place. The hole in piston is continuous with those in cylinder when the handle is turned to the extreme limits of the guides. From 300 to 400 c.c. of blood can be introduced without change of syringe. The instrument is heavy enough to rest on table between donor and recipient, and can be easily cleaned. (Plate II.)

Another apparatus devised by Farr and Gilroy[9] consists of an Erlenmeyer flask arranged the same as a wash bottle with a long glass tube from the bottom through a rubber cork and out, having a bend of 45° on the outside, *A*. One other short tube, *B*, extends into bottle about .5 in. and about 1.5 in. on the outside. Tube *A* is connected with a rubber tube and at the distal end

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(8) Surg, Gynecol. and Obstet., December, 1918.
(9) Ibid., March, 1919.

of tube there is an adapter, *C*, to fit either a Luer or Record needle. Tube *B* is plugged loosely with sterile cotton and connected with a long rubber tube, at the distal end of which is a glass tube, *D*. The glass tube is likewise plugged with cotton and used as a mouthpiece from which point by suction the operator is able to create a negative pressure in the bottle. In the preparation the usual technic is followed as to application of the constrictor, sterilization, etc. Citrate in sufficient quantity to make a 0.2 per cent. solution of the citrated blood may be introduced into the bottle before cork is inserted or this may be done fractionally by suction after removing the adapter and placing it in citrate solution.

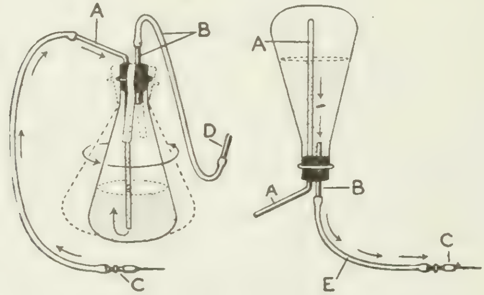

Fig. 39. Transfusion apparatus (Farr-Gilroy).

They usually hold the cork in place by adhesive tape so the second stage of the procedure may be performed without danger of the cork coming out when inverted. With the needle inserted peripherally into the donor, by suction negative pressure is produced in the bottle. The blood then runs through *A* to the bottom of flask which is continually agitated, and the blood at once intimately mixed with the citrate. If the vacuum is too great, it may induce a valvelike action at the tip of needle, the wall of vein closing over orifice. Then the adapter is simply loosened from the needle and normal tension restored. By this same means tube *A* may be evacuated of blood at any time and thus the possibility of clotting in the tube is eliminated. Having completed the withdrawal of blood, almost as simple as taking blood for a Wassermann, the bottle is inverted, the long tube *A* becomes the air intake, the short tube *B* becomes the tube of exit which tube is connected with another long rubber tube *E* in the same fashion as in the administration of saline by the gravity method. The whole apparatus, including a bottle of citrate (grams 2) with needles No. 16 may be autoclaved and wrapped so the operation can be accomplished with but little preparation and with no delay. The application of these simple laboratory methods minimizes the possibility of contamination and makes for simplicity of operation.

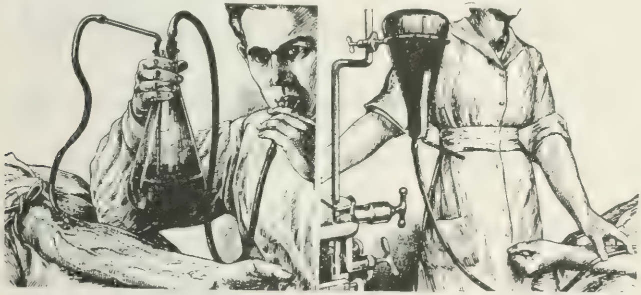

Fig. 40. Same in use.
Fig. 41. Same (Farr-Gilroy).

The *syringe-canula method* devised by E. Lindeman was quoted in the 1917 volume (p. 187). In his latest article[1] he relates 214 consecutive cases. The outfit consists of 6 syringes, 2 tourniquets; and 2 sets of canulas, for the donor, and for the recipient. There are 3 canulas to each set, each telescopes within the other. The innermost canula is practically a hollow needle, 2 6/16 in. long, 30-gauge, with one end ground to a fine point and short bevel. The hollow needle is fitted snugly into Canula 2, which is 5 mm. shorter than the needle and is fitted snugly into Canula 3. No. 3 is 5 mm. shorter than Canula 2. The proximal ends of 1 and 2 are capped with stationary thumbscrew caps, that of 3 with a receiver to fit any Record syringe.

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(1) Jour. Amer. Med. Ass'n, June 7, 1919.

Canula 3 is 2 in. long, 14-gauge, the caliber is the same as the tip of a Record syringe. In very small infants with very small veins only 1 and 2 are employed, 2 being capped with the receiver to fit the tip of syringe. The syringes can be sterilized in 95 per cent. alcohol for 10 min. and then rinsed in saline.

The important factors essential are: (1) The method must be applicable in any case and in any disease. (2) It must be possible to transplant any amount necessary to obtain the most desirable clinical results. (3) The blood must be transplanted exactly as it exists in the donor, namely, in its natural state; to do this, (4) must pass through a minimum amount of foreign material; (5) must be out of donor and into the patient in a minimum length of time, and (6) must be free of reactions.

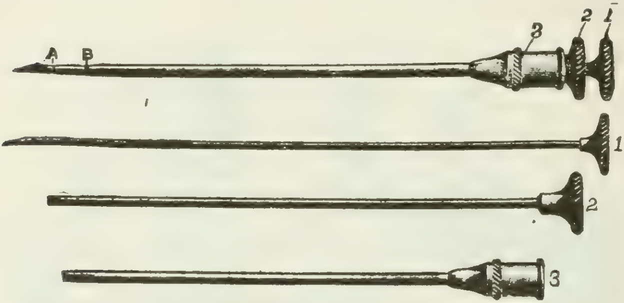

Fig. 42. Syringe-canula for transfusion. *A*, distal end of No. 2; *B*, same of No. 3. 1, innermost canula or hollow needle; 2, middle and 3, outer canula (Lindeman).

Of the 214 transfusions, there were 108 in pernicious anemia. On some of these patients transfusion was performed from 15 to 20 times. There was in 18.5 per cent. a posttransfusion rise of temperature of 3° or more. There were 26 for hemorrhage. There was a rise of temperature of 3° or more in 12 per cent. There were 80 transfusions in the miscellaneous group. Of these 12.5 per cent. had a rise of 3° or more. In the pernicious anemia group there were more patients who received larger amounts of blood. The larger amounts rather than the disease is responsible for the small increase in percentage. By the syringe-canula system blood may be transplanted with very near approach to the ideal. In any quantity and the very disagreeable reactions many times following transfusion be avoided.

The apparatus successfully used by Hunt and Ingleby[2] for the *intravenous infusion of whole blood* is simple and easily made in an ordinary laboratory. The main

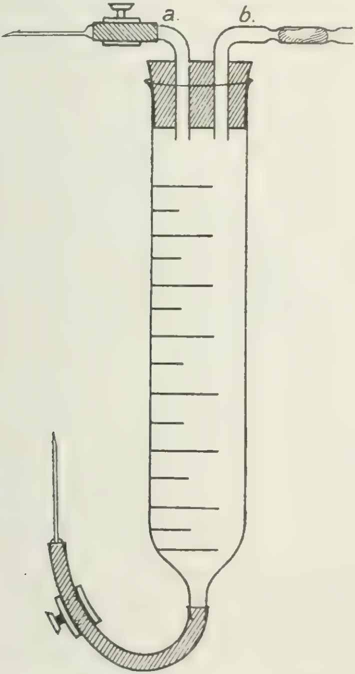

Fig. 43. Transfusion apparatus for whole blood (Hunt-Ingleby).

is a graduated glass cylinder of about 300 c.c. capacity with an outlet at the bottom. Through a rubber cork pass glass tubes, *a* and *b*. To *a* is attached short rubber tubing on to which is a large-bore needle for collecting blood from the vein; *b* has a sterilized plug of wool to filter the air entering the cylinder. This tube is

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(2) Lancet, June 7, 1919.

connected with an aspirator while the blood is flowing into the cylinder and with a spray bellows when flowing into recipient's vein. It is desirable to have some clamp to prevent the cork coming out when the pressure is raised inside cylinder. The outlet is connected to the needle for the patient's vein by rubber tubing. Clips are placed on various tubes to close them when required. The apparatus is sterilized by boiling, and before use 10 c.c. of sterile 0.9 per cent. sodium citrate are introduced to prevent clotting. When ready the upper needle is inserted into vein and the required quantity collected. This needle is then withdrawn, tube *a* clamped, and the lower needle inserted into patient's vein. The lower tube is then unclamped and blood allowed to flow into patient's vein, the flow being increased by raising the pressure into the cylinder. With a little practice transfusion can be done in 15 min.

Robertson's citrate method was used by J. E. McCartney.[3] The apparatus consists of a litre bottle having a tight-fitting cork with 3 holes. The bottle was graduated at 160, 660, 760, 860 c.c. The tube *D* was wide-bored glass tubing, connected by a *short* rubber tubing *C* to a hollow needle *A*. This needle had an internal diameter of 1½ or 2 mm. A clip *B* closed the rubber tube *C*. Blood was drawn in from the donor through this tube. The tube *E* just passed below the cork and had a length of rubber tube and a mouthpiece, so pressure or suction could be applied. The blood was given to patient through the needle *F*, which had an internal diameter of 1 mm. The bent tube *H* was to ensure the bottle was completely emptied of blood. A 3.8 per cent. solution of potassium citrate (isotonic with blood) was run in up to the 160 c.c. mark. The cork and its tubes were inserted, and *D* adjusted so the end just dipped beneath the solution. The clip *G* was closed, and the clip *B* opened. By the mouthpiece *J* the pressure in the bottle was raised so the citrate solution was forced out of needle *A*. The tube *C* was clipped so that the system *A C D* was full of citrate solution.

A donor having been selected, the skin over median

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(3) Edinburgh Med. Jour., September, 1919.

basilic was sterilized by alcohol, ether, and iodin. After constricting the vein, the needle was introduced into vein, the clip released, and suction applied by the mouthpiece, the blood immediately flowing into the citrate solution. The bottle was gently rotated to mix blood and citrate, and when the fluid rose to the marks 660, 760, 860 c.c., it indicated 500, 600, or 700 c.c. had been taken. When sufficient has been removed the clip was put on, and needle withdrawn. If the needle is withdrawn first, clot is drawn from *C* and *D* into bottle, and this must be avoided. Clip *G* was then opened, pressure forced into the bottle, and the citrated blood flowed out of *F*. The clip was closed and *F* inserted into vein, and blood given exactly the same as a gum-saline infusion. A Higginson syringe was used to obtain this pressure necessary. Of course, asepsis was used; and in all cases the blood groups of both ascertained, if possible, a donor of same group selected.

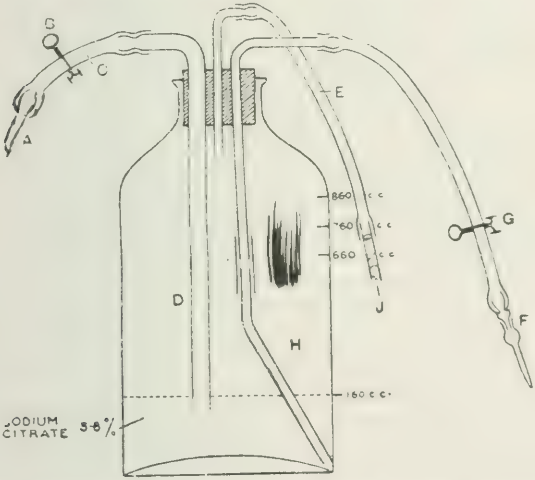

Fig. 44. Apparatus for Robertson's citrate method (McCartney).

A simple and efficient *method of coating tubes with paraffin* is described by B. H. Alton.[5] The sterilized

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(5) Jour. Amer. Med. Ass'n., Aug. 16, 1919.

tubes are rinsed with a small amount of alcohol followed by a small amount of ether. About 1 oz. of a paraffin-ether solution (paraffin, 1 part, 127° F. melting point, and 80 parts of ether) is poured into the tube. The tube is shaken and rolled so the solution bathes the entire inner surface. A small amount is allowed to pass through the canula to insure a coating of its lumen. The remaining solution is quickly emptied through the top of tube. The ether which remains quickly evaporates, leaving a thin, even coating of paraffin. A rubber cork should be used with this method. It is prepared by pouring some paraffin-ether solution over it and the ether allowed to evaporate. The cork and tube are now wrapped in a sterile towel. A tube coated by this method gives better results if not used for several hours after preparation, as it allows more complete drying of the paraffin. The procedure is carried out under aseptic precautions. The paraffin should be sterilized in an autoclave before mixing with ether.

End-Results. MM. Richet, Brodin and Saint-Girons,[6] made some animal experiments to ascertain the effects of intravenous *injections of artificial serum in hemorrhage.* These included sugar-salt, pure sugar, pure salt, Locke-Ringer, etc. They found the best one to be 7 parts of sodium chlorid, and 5 of lactose or sucrose to 1000 of water. But while this is capable of keeping animals alive for a few hours by replacing the contents of the vessels, with the action on heart and the respiratory centre, it does not allow indefinite survival. *Transfusion alone, in these desperate cases will save life.*

In 4 months, Fleming and Porteous[7] did *100 citrate transfusions.* These were all in fractured femurs in which either secondary hemorrhage had occurred or the limb had been amputated and much blood lost. In many there had been a secondary hemorrhage, and as a result the limb was amputated, causing a further loss of blood. In only one did any alarming symptoms follow and this was probably due to giving the blood too fast. There was extreme dyspnea, the patient lost consciousness, and pulse became very rapid and feeble.

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(6) Presse Méd., Nov. 14, 1918.

(7) Lancet, June 7, 1919.

This only lasted about a min., during which the transfusion was suspended, but after another min. the remainder was given very slowly and without any symptoms. In one or two when patient had received 100 to 150 c.c. he complained of "tightness in the chest," but this was always quite transient, and on stopping the flow for about ½ min. the transfusion could be proceeded with without mishap. A quite frequent symptom where limbs had been amputated was the onset of pain (sometimes considerable) in the stump. They said the stump was "swelling up and bursting." This seemed to be the direct result of the infusion, as it ceased when the flow was stopped and recommenced when started again without the patient's knowledge.

The usual result was a very great increase in the volume of the pulse, with some diminution in the rate. In most cases this improvement was maintained. There can be no doubt that in a very fair number the effect was to prevent death from the shock following hemorrhage and operation. All these cases were complicated by the severe sepsis (to which the secondary hemorrhage was due). A certain number never recovered from the shock of operation, but these formed only quite a small proportion. Most of the deaths were from sepsis. The transfusion can be repeated as often as necessary. One patient received 6 transfusions.

R. Lewisohn[8] the inventor of the citrate method gives the *clinical results in 200 cases:*

Disease	Cases	Transfusions	Cured	Improved	Not improved	Unknown	Died
(*a*) Hemophilia and allied conditions	14	15	11	..	..	..	3
(*b*) Purpura	16	20	4	5	..	2	5
(*c*) Gastro-intestinal hemorrhage	11	20	2	1	..	..	8
(*d*) Cholemia	5	11	..	..	..	..	5
(*e*) Postoperative hemorrhage	13	16	6	..	..	..	7
(*f*) Hemorrhage from female genital organs	2	2	..	..	..	..	2
(*g*) Traumatic hemorrhage	2	3	1	..	..	..	1

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(8) Amer. Jour. Med. Sci., February, 1919.

2. Diseases of the blood:							
(*a*) Pernicious anemia and leukemia	24	39	..	7	4	..	13
(*b*) Primary and secondary anemia.	4	7	3	1	..	..	..
3. Preoperative and postoperative transfusions	35	39	12	..	..	..	23
4. Sepsis	5	7	..	.	..	..	5
5. Incurable conditions (transfusions performed at request of family)	12	12	..	..	..	..	12
6. General debility	6	8	..	1	..	1	4
7. Acute poisoning	1	1	1	..	..	..	..

He states large transfusions may overstrain the heart and cause death. Except in profuse hemorrhage the average amount should range between 500 and 700 c.c. Very large ones are no more effectual than those of medium size. Nothing is known as to the fate of the blood after introduction. In many instances it acts as a stimulant for the blood-producing organs as shown by the rapid automatic rise of the Hb. in a few days, and obtained just as effectively by transfusions of medium size. The amounts of citrate used are so small they do not play any rôle in the chemical and clinical properties of the recipient's blood. "Even after profuse hemorrhage there is enough calcium left in the blood-vessels and in the lymph for re-establishment of coagulation conditions in the transfused blood" (Sabattani). *I. e.*, the mixture of citrate is efficient as anticoagulant only while blood is outside the body. Soon after introduction the coagulating efficiency of the transfused blood is fully reëstablished. It is probable the citrate is either changed or rapidly excreted by the kidneys.

Judging by the experience of Lewisohn, chills occur somewhat more frequently with the citrate than with other methods. In the series of 200 he encountered chills in 40. The reasons for these chills, if proper blood tests were made before the transfusion, are not quite clear. He has repeatedly seen that in the same person citrate transfusions did not cause any chills, whereas subsequent transfusions of non-citrated blood caused acute rise of temperature with chills, and *vice versa.* It is interesting to note that in the first 22 transfusions no chill occurred. Furthermore, it was never observed following transfusion given to children, even when rather large amounts of blood, as compared to the body weight, were introduced. Nor in any transfusion following a profuse hemorrhage.

According to J. de J. Pemberton[9] *1036 transfusions* were performed on 429 patients between Jan. 1, 1915, and Jan. 1, 1918, in the Mayo Clinic. Five were done by means of the paraffin-lined cylinder, 30 by a modified canula-syringe technic, and 1001 by the citrate method.

1. Primary (pernicious) anemia, 657 transfusions in 185 cases.
2. Secondary anemia, 243 transfusions in 149 cases.

Chronic infection	24 cases
Malignancy	44 cases
Chronic hemorrhages	43 cases
Acute hemorrhages	7 cases
Hemolytic jaundice	4 cases
Splenic anemia	10 cases
Actinomycosis	2 cases
Causes unknown	15 cases

3. Bleeding, 81 transfusions in 59 cases.
4. Acute toxic and septic conditions, 34 transfusions in 25 cases.
5. Leukemias, 20 transfusions in 10 cases.
6. Shock, 1 transfusion in 1 case.

In 219 transfusions of the series, there occurred from 15 to 60 min. later a slight reaction of chill and fever, a temperature of 100 to 105 F., with or without malaise, headache, nausea and vomiting and diarrhea, and followed, in a small percentage, on the 3d day by an eruption of herpes. In another 15 per cent. there occurred a rise to 100 F. or above, without chill and nausea. These were, in every instance, transitory, and in only 2 instances was it at all probable that the transfusion was vitiated by this complication.

THE BONES.

J. L. De Courcy[1] had occasion to operate on a boy, of 12, with *osteitis fibrosa.* He was admitted with a fracture of humerus, but palpation disclosed an elongated, bony swelling in the upper $^1/_3$, with point tenderness, crepitation and mobility at the corner of the swelling. The boy had been vaccinated 10 months previously, the reaction very severe. For 10 months had continually

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(9) Surg., Gynecol. and Obstet., March, 1919.
(1) Jour. Amer. Med. Ass'n, May 31, 1919.

complained of dull, rheumatic pains in upper arm, medication and external applications without relief. The roentgenogram on admission showed a rather marked absorption of bone in upper humerus, giving the impression of a cyst, and through this were fracture lines.

The operation revealed a cyst about 2½ in. long, filled with bloody matter. The inside of the wall was covered with what appeared to be granulation tissue. Because of the thinness of the wall and the uncertainty of the diagnosis, the whole cyst, with some healthy bone from each end, was resected, and a strip about 3 in. long and ¼ in. thick from tibia, with periosteum, was transplanted into the medullary cavity of the upper and lower fragments. The periosteum was sutured over and wound closed. The wound healed by first intention and *x*-ray a month later showed the graft in position, with a large amount of callus covering it. Three months following firm union between the fragments.

[In the 1913 volume (p. 562), J. B. Murphy gives an account of a similar case.—Ed.]

Concerning *typhoid lesions of bone,* G. Bohmansson[2] comes to the conclusion that multiple foci are probably commoner than shown by statistics. A condition of disease can occur even when no clinical record of typhoid can be found; the course of the primary disease is without significance for the appearance of bone metastasis. It is not necessary that Widal's reaction should give positive result, even if multiple foci exist. Systematic Röntgen examination is desirable for the entire skeleton in isolated bone foci, to determine the treatment. The diagnosis can be made with certainty only by bacteriologic examination of the foci discovered. Radiograms show nothing specific, only the existence and localization of foci. The single foci are quickly and securely accessible for operative treatment. Vaccination therapy has, theoretically, the possibility of hindering the further development of bacteria, at least where Widal's reaction is negative. Autogenous therapy has been used once without discomfort and with apparently good results. There seems to be good reason for its continued use.

[See also the extensive statistics of J. B. Murphy—1917 volume, pp. 202, 300, 540.—Ed.]

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(2) Annals of Surg., March, 1919.

Several examples of *fragilitas ossium associated with blue sclerotics* were referred to in the 1919 volume, (p. 220-1). Another one came under the observation of W. D. Wise:[3] A boy, of 5, playing on the floor suddenly complained of his leg and began to cry, refusing to put weight on the foot. He had not been doing anything that would have been likely to cause an injury. The *x*-ray revealed a fracture of the lower third of tibia, and upper fibula. The mother had sclerotics of the same color and had had 3 fractures of the right humerus and 2 of the left, all from trivial causes. Her father was reported to have the same type of eyes and to have had fractures of the clavicle and humerus, but apparently from rather severe falls. The patient's 2 brothers had blue sclerotics, but no broken bones.

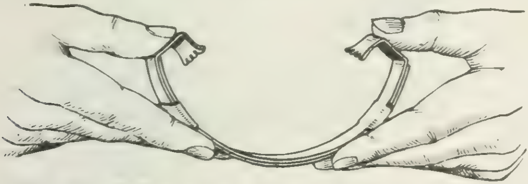

Fig. 45. Self-retaining retractor (Lowman-Pratt).

Transplantation and Grafts. Lowman and Pratt[4] introduce a *self-retaining retractor* for use with the Albee bone outfit. Made of 2 arcs of spring steel fixed together by lateral lips. The toothed portions are broad to give greater and more even retraction. The teeth are rounded and the angle of adjustment between the retracting edge and the upper short horizontal surface is such that at no time is there any indentation of tissue except over an area sufficiently broad to prevent trauma. The lateral lips furnish a simple friction lock whose function is increased by any force exerted upon the two parts except exactly in the direction of its arc by means of which the retractor is opened and closed.

To apply the retractor, the limb, having been sterilized in its entire circumference, is lifted, the retractor sprung open sufficiently to slip on from below nearly to encircle the limb. the toothed edges being brought to either

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(3) Jour. Amer. Med. Ass'n, Nov. 29, 1919.
(4) Surg., Gynecol. and Obstet., December, 1918.

side of the proposed incision. Two retractors should be used in the average case. They can be pushed up and down out of the way until the incision and the exposing dissections are made. The cut surfaces are covered by towels laid lengthwise and their surplus width is tucked in about the limb and inside the grasp of retractors. The toothed edges are made to engage in the depth of the wound on either side of bone and each half pushed back into the reciprocating embrace of the other until the desired exposure is accomplished. Any unevenness of the protecting toweling is corrected. The operation is performed and when finished retractor removed by pulling up on the horizontal place of one-half and pushing back in a circular direction upon the locking end of the other half on the same side of limb. It will be advisable to have a larger and smaller size for thigh, forearm and extremities of children.

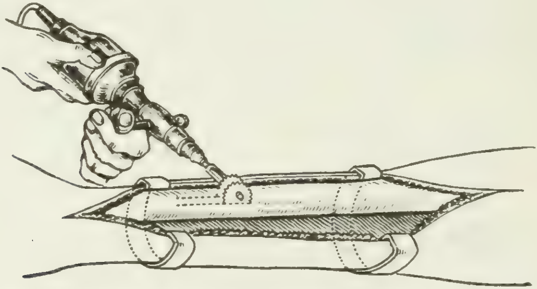

Fig. 46. Retractor in position—towels omitted for clearness of figure (Lowman-Pratt).

From his *studies in bone transplantation*, B. Brooks[5] concludes that autogenous transplants of normal bone with periosteum and endosteum fail to regenerate successfully defects in bone in relatively large proportion of instances if done in animals well advanced in life. Autogenous transplants of growing bone succeed in a much larger proportion than bone not in the state of active growth or regeneration.

L. Mayer[6] contributes *further studies in osteogenesis.*

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(5) Annals of Surg., February, 1919.
(6) Ibid., April, 1919.

Despite Macewen's stimulating monograph, our knowledge of the exact changes in the autogenous graft subsequent to transplantation, is in many respects uncertain. There are at least 2 views relative to osteogenesis. The first, by Macewen, maintains that osteogenetic activity resides in the bone cells, that osteoblasts pour out of the bone subsequent to injury or transplantation, and the periosteum acts merely as a limiting membrane. The other view, dating from Ollier (1867) supported by Axhausen, emphasizes the importance of the periosteum as the bone producing tissue. According to the first view, the bone cells live subsequent to transplantation, multiply and are capable of the same activity as transplanted epidermal cells. According to the opposing view, the cells die and regeneration occurs through the activity of the transplanted periosteum and of the adjacent bone into which the transplant has been inserted; *i. e.*, the transplant acts merely as a scaffolding. This important discrepancy brings in its train other divergencies of opinion, concerning not only the histologic processes, but the best technic. Thus, for instance, some believe in the use of boiled bone rather than the autogenous, graft on the theory the graft acts merely as a scaffolding.

Details are then given of 2 specimens one from a man, aged 39, who died from carcinoma of the spine; the other from a child, of 9, who died 18 months after an Albee operation. Study of the specimens, with extensive animal experimentation, show the fully developed bone cell has no power of division and that bone growth results from the activity of cells between the bone and the outer layer of periosteum. When these cells are removed, the bone itself is not capable of reproducing them, but the periosteum has that power. In transplantations, the graft acts partly as a scaffolding for the ingrowth of osteogenetic cells, but it contributes also to its own life, first by the persistence of some of its bone cells, second by the activity of the transplanted periosteum. The graft grows in its new situation and becomes modified in its form according to the changed mechanical conditions. (Wolff's law.)

The *fate of the bone graft* is discussed by W. Campbell[7] based on a clinical study of 75 autogenous grafts. In most instances the bone was taken by a motor saw from the shaft of the tibia, not using the crest, the removal of which may weaken the bone.

In 20 ununited fractures successful *x*-rays were made at frequent intervals for from 6 to 24 months. Twelve of these were of the neck of the femur. In 1 there was no apparent change at the end of a year though union had occurred. In 11, gradual disintegration could be seen to such an extent that complete absorption could be predicted; though one could not expect otherwise, from a pathologic standpoint, when we transplant dense into spongy bone. In ununited fractures of the long bones the inlay was employed in 4 cases and the medullary in 4. All the medulla transplants were absorbed, while the inlays remained intact. Campbell has been able in only 3 instances to observe the course of the graft in bone defects. In one, the graft was rapidly disintegrated and absorbed, with massive, diffuse callus closing the defect, or possibly obscuring the graft. In another there was no apparent change, and in the third a gradual, bony thickening of the entire graft.

From a close analysis of these cases he surmises in adolescents and young adults, grafts are more vigorous and apparently act as a living, integral part, showing no disintegration, but a gradual increase in size and thickness. The inlay is the physiologic method. The intramedullary should not be employed where osteogenesis is feeble. Spinal grafts in young children, and probably in adults, are absorbed.

The graft may be inert or very feebly osteogenetic but mechanically perform the function for which it was employed,—as in the neck of femur (dense into spongy bone). From the *x*-ray in a few cases bone appears to form in strata about the original graft very much as an involucrum about a sequestrum, though no definite evidence has been produced.

Osteomyelitis. Considering the *pathology and treatment of osteomyelitis*, A. R. Colvin[9] remarks that unless we think of periostitis as really part of an ostitis we are

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(7) Southern Med. Jour., September, 1919.
(9) Minnesota Med., December, 1918.

liable to err in treatment. In acute hematogenous infections the incidence of periostitis means the infection has travelled from the interior and pus has accumulated under periosteum. We have been deceived in the past because on opening such collections the condition was recovered from at once and hence we concluded the interior of bone was not involved. We know now, however, that even with extensive involvement of the interior, Nature may establish drainage and the condition be recovered from without surgery of any kind. Nevertheless it is exceptional and must not influence us in our treatment of acute infections except by proving that periostitis is not an independent condition and that opening the bone is essential. The mere opening is neither difficult nor hazardous. The difficult part of the dissection is to reach the bone. Joint complications, necrosis with its prolonged and complex pathology, will be less common if the opening in the bone is extensive enough for competent drainage.

Having recognized the osteal character of the infection, its localization is the next most important item in pathology. Often the trouble is located in the shaft rather than in the epiphysis, indeed epiphysitis in pyogenic disease is quite rare. The anatomy of each individual bone must, of course, be kept clearly in mind to realize the possibility of shaft, epiphyseal and joint involvement. The frequency of arthritis of the hip in infections of the upper femur is due to the fact the diaphysis is included within the capsule. In most other joints only the epiphysis is thus included and consequently because of the infrequency of epiphyseal involvement purulent arthritis is uncommon, the attending swelling being as a rule serous. The infecting agent having arrived at a certain point in the vascular areas of the bone, the resulting conditions will depend upon the virulence of the invading microbe and the resistance of the organism. An acute general septic invasion where the bone infected is but an incident in the process of annihilation of the individual, contrasts markedly with an infection of bones so indolent that sarcoma is mimicked. Drainage having been established, restoration to the normal may occur especially in the young. On the other hand, in spite of drainage, destruction may proceed slowly, necrosis may have been limited rather than prevented, and the complex condition of sequestrum formation and bone regeneration in varying ratios, is encountered.

Bone production goes hand in hand with bone destruction in the chronic stages and may result in localized thickenings on the surface, or in a surrounding new shaft, or in a uniform thickening of the old one. This latter may result from a slowly progressive infection without any actual destruction. The recognition of these facts is of the utmost importance to interpret the complex condition as seen in the radiogram. It is sometimes said if acute osteomyelitis were treated properly there would be no chronic stage. This is only true in part, for many cases are so insidious marked changes have occurred before the patient has had any symptoms impelling them to seek assistance. It is in these chronic forms that the greatest difficulty in diagnosis occurs because of the tumor-like thickening with few symptoms; and tumor-like masses of indurated tissues surrounding the bone increase the difficulty.

After the removal of the sequestra, each case demands separate consideration as to the best means of dealing with the resulting cavity. In the young where osteogenesis is comparatively rapid, bone-wax is especially valuable if for no other reason than furnishing a kind of drain, but occasionally where drainage ceases it keeps the cavity filled until osteogenesis has built sufficient new bone to obliterate the cavity from which the wax has been gradually absorbed. In adult bones where osteogenesis is slower or may fail to accomplish the desired result, the plastic use of bone, muscle, fat or skin may be desirable. During the course, joint contractures are prone to occur, and the protective and mechanical treatment to prevent these are of utmost importance. Where the sequestrum involves a large part of the shaft, fracture of the involucrum may also occur if protection is not sufficient.

In *bone regeneration following osteomyelitis*, S. L. McCurdy[1] is of the opinion it is from the osteoblasts

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(1) Railway Surg. Jour., September, 1919.

only, and cannot come from the periosteum or other tissue. Sequestrum, though very loose, should never be removed until regeneration of new bone has advanced far enough to maintain the normal position and perform the normal function of destroyed bone. Iodin (3.5%) is the antiseptic *par excellence* in all bone infections. It should only be used once a week. Packing, as used by the average surgeon, namely, in and around bones that are dead, destroying the healthy granulations, also destroying the bone's normal function of producing new bone throughout its circumference, should not be used. This has done more harm to bone surgery than any other one thing that has happened in centuries. The serum of repair is not pus, since it is not phagocytosis and does not require strong wet dressings, as practiced by so many as a routine. Normal salt is to be preferred when the patient is without temperature.

Vaccine treatment was used by R. Grégoire[2] in 8 children—infants and older—with acute staphylococcus osteomyelitis. To save time a stock vaccine was given pending preparation of the autogenous one, but in some instances the effects were so good this stock vaccine was used throughout. The initial doses were only 0.1 c.c. (about 200 millions), as a rule, from 2 to 7 injections were given, at variable periods controlled by cardiac and renal manifestations. Within 8 to 10 hours, the pulse rises and remains high for a few days. There was albuminuria of mild degree for short time, as a rule; in one child it persisted over 3 months. Where the general condition is grave the treatment is of no avail, 2 children with septicemic symptoms succumbed. The others began to improve in a day or so, and in a fortnight to month could use limbs without pain. In the 4 months elapsing to date of report there were no recurrences.

Treatment of Sinuses and Fistulæ. Though C. J. Symonds[3] has been using *solid metal drains* for over 25 years, he has not seen them referred to for war wounds. The metal prevents closure of the orifice, which neither a rubber tube nor gauze will do. It also rapidly reduces the septic changes, and by preventing retention of pus

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(2) Paris Méd., Oct. 11, 1919.
(3) Lancet, June 7, 1919.

permits the formation of new material and closure of the cavity. Rubber and gauze both cause irritation, and the latter always some bleeding, which increases septic changes. The rod is smooth with round end and can be removed and inserted without injury. When substituted for gauze the benefits are at once apparent in disappearance of dermatitis nearby, and marginal granulations, and decrease in discharge. Pain, if present soon subsides, and a retraction of orifice may quickly be seen. The patient can get about, one of his early cases with a tube in tibia was a chauffeur. Aluminum answers well, but of late Symonds used glass bent to any desired angle. He has often used such rods for the tibia, femur, tarsus and carpus. The lessened discharge is striking, so hand or foot can be put in plaster at once.

The *treatment of chronic bony fistulæ* is elaborated by R. A. Stoney.[4] Late in '18 he saw many cases. Earlier he had removed the focus of infection as thoroughly as possible, with all dead or foreign material, and disinfected with pure carbolic and iodin, plugging the whole for 48 hours with iodoform gauze, then allowing it to granulate.

While 70% or more were cured this was lengthy, and in a certain proportion the plan failed even after 2 or more operations. Stoney thinks he has overcome this difficulty by the use of modified bipp. The chronicity of these cases is because the infection is firmly implanted in the bone, and frequently a sequestrum or foreign body is present. If on *x*-ray examination either of these is present, no cure can be expected from any treatment, which does not include their removal. If possible the fistulous track should be excised right down to the bone, and the more of the fibrous scar tissue removed the better. When the bone is reached, the periosteum should be raised for some distance all round the opening. The whole infected areas should be thoroughly laid open, all sequestra and foreign bodies taken away, all overhanging walls removed by forceps or chisel, until the walls of the cavity slope gradually to the deepest point. If possible the walls should be gouged away till healthy bone is reached, as is shown by free oozing from the cut surface.

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(4) British Med. Jour., June 21, 1919.

Frequently it is not possible to carry out this step of the operation completely. The whole wound is now dried and swabbed with ether or methylated spirit and packed for 2 min. with gauze wrung out of one or other of these liquids. Modified bipp (iodoform 2, bismuth 1, and vaseline 12) is then rubbed into the walls of cavity, which finally is filled with it. If small and regular, and it has been possible to remove its original walls fairly completely, and there is a good depth of healthy tissue between it and skin, the wound may be closed in layers. Gauze smeared with bipp is placed over the wound, and a thick layer of wool and a firm bandage is applied. If all goes well, the dressing need not be changed till the stitches are removed about 10th day, when the wound will be found firmly healed.

If not thought safe to close the wound it is plugged tightly with a long strip of iodoform gauze impregnated with bipp. The wound is first dressed at the end of 48 hours, when on removal of the gauze a perfectly dry clean cavity should be left. It is filled with bipp. A superficial dressing is applied and changed every 4th or 5th day, fresh bipp being put into the cavity as fast as it disappears. It is a surprise how quickly a large cavity will heal under this treatment; in no circumstances should curiosity ever tempt one to put a probe into one of these cavities during healing, or interfere with it in any way. The healing can often be hastened by inserting loose sutures at the operation and tying them at the first or a subsequent dressing. In some few cases it may be advisable, if the cavity left is very large, to undertake a special operation for suture at the end of about a week, when it is seen that the wound is dry and that there is no further tendency to suppuration. The reason for plugging tightly for 48 hours is to check the hemorrhage and get a perfectly dry wound; the bipp with which it is then filled is as nearly as possible innocuous to new formed granulation tissue, and is pushed out as the latter fills up the cavity, till finally epithelialization can take place. One great advantage is the gauze impregnated with bipp can be removed without causing fresh hemorrhage, as it does not stick to the cavity; its removal is practically painless. There is probably no special virtue in iodoform gauze, beyond the fact it is easily obtained in suitable widths without ravelled edges.

Stoney had under his immediate care 25 chronic bony fistulæ, which had lasted from 2 months to over 4 years. The average duration from wounded until operated on was just over 16 months; and more than one had already been operated on 7 or more times. Practically all the larger bones of both extremities, and also the ribs, sternum, pubis, and crest of ilium, were so treated. In 22 the wounds were completely cicatrized when the patient left. One required a small secondary operation, under cocain before he could be evacuated. All the others were submitted only to one operation; in 12 cases the operation was concluded by plugging, in 9 by complete suture, and in one the wound was partially sutured and partially plugged. In these 22 the average time between the wound and the curative operation was exactly 16 months, whereas the average stay after operation was only 33 days. Eight were healed in a fortnight, though 3 had had previous treatment over 40 months. Only three remained in hospital 2 months or longer; the longest period was 10 weeks, and he had been previously treated for 17 months. There is a large field for this treatment for chronic otitis and mastoiditis.

[See also Stoney's treatment of Septic Wounds.—Ed.]

Stoney's plan was *used with good results* by A. K. and D. K. M. Henry.[5] In 15 consecutive cases there were 2 which did not heal after a single operation (one healed 6 weeks after a second). Of the successful cases, 6 healed in a month, 4 in six weeks, 1 in seven weeks, the other 2 were delayed by trophic eczema from nerve injury. Of the total 15, some 11 were sutured, in 4 this was impossible, the sinus being included in an extensive scar, and plugging (Stoney) was done.

Osteoplastic closure of bone cavities is advised by C. J. Marshall.[6] Broca's method is to remove one of the walls to permit the soft tissues to contact with the remaining walls. This involves an extensive removal, particularly as the tissues in the region of bad gunshot fractures are usually far from soft. Sargent described

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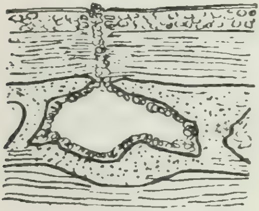
(5) British Med. Jour., June 21, 1919.
(6) Ibid.

a method which obviates the above disadvantage by using a muscle flap which needs a very much smaller bone removal to permit of its introduction.

It is possible to classify bone cavities into 2 types: (*A*) Where the sinus passes through a considerable thickness of soft tissues: the necessary thickness varies with the size and shape of the opening into the cavity and the amount of scarring of the parts. (*B*) In subcutaneous bone or where the superficial soft parts have been destroyed—the skin is bound down to the bony edges. Only failure can result from freeing the skin edges and suturing over a bipp filling. The (A) cavities react readily to bipp—overcoming of sepsis, and the stimulation of osteogenesis play a part; certainly a free growth of granulation occurs. Cannot the cases in (B) be converted into Class A? Can we provide a durable covering for a filling? The lid might be made by a sliding skin-fat-periosteum-bone flap.



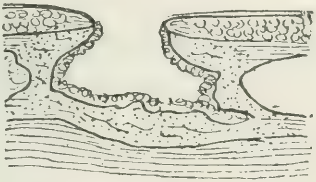


Fig. 47. Bone cavity—Class A.
Fig. 48. Same, Class B (Marshall).

A sample operation was one on a man wounded March 26, 1918, admitted Jan. 24, 1919. *X*-ray showed sequestra in upper tibia with sinus 1/4 in. wide, Feb. 1, a small vertical incision with sinus at its middle; several large sequestra removed, and carious bone curetted away till healthy tissue was reached. The cavity cleansed with peroxid and packed with flavine gauze. The opening in the bone measured 1/3 in. by 1. In 24 hours the packing was removed and intermittent irrigation instituted; flavine and Dakin's solution on alternate days (3- and 6 times respectively). A smear Feb. 25, showed 2 bacilli and 2 streptococci per field.

Feb. 27 the cavity was first curetted again and all new granulations removed; interior cleansed with peroxid, dried, and packed by gauze soaked in iodin. The skin again cleaned. Next the skin incision was prolonged up for a short way, and converted into a J (diagram). The skin and subcutaneous tissue at the lower part of flap were raised as far as lower level of opening, where a transverse incision in the periosteum extended to post. tibial border. A vertical incision in periosteum 1 in. long was next made, extending vertically from the upper limit of opening, and through this incision the periosteum was lifted, with fat and skin, as far back as the tibial border, by means of a fine sharp periosteotome. The bone slice from cortex was raised by a fine chisel; the cuts were made along (1) the periosteal incision below, (2) the lower level of periosteal detachment above, (3) and then into the side of the cortex at the opening; by a combination of chiselling and gentle leverage a flake, $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. transversely, was raised, the posterior attachment being fractured. To permit this flap to slide into place, it was necessary (A) snip with scissors periosteum at post. border of bone flake and extend this cut to upper limit of periosteal attachment. (B) Undercut skin posteriorly. The ant., upper and lower borders of opening were

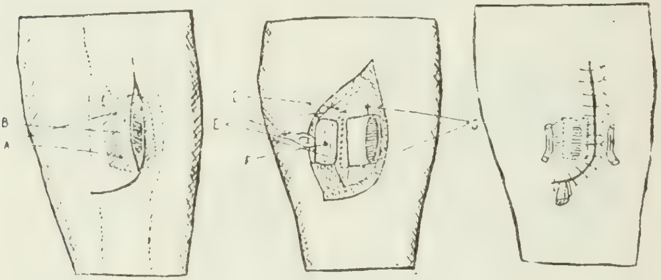


Fig. 49. Osteoplastic closure of bone cavities. *A,* extent of cavity; *B,* opening of cavity.

Fig. 50. Same. *C,* incisions in periosteum; *D,* flap of periosteum; *E,* cut in periosteum freeing flap; *F,* bone flake.

Fig. 51. Same, suturing (Marshall).

levelled with chisel so flake could sit squarely in place. A further strip of skin was excised along ant. border so suture line is well away from opening. The whole area was cleansed with peroxid, hemostasis attended to, and packing removed from cavity, which was filled with bipp. The flap was fixed by (1) interrupted gut sutures through skin; (2) a wide mattress-suture passed deep to bone flap (diagram). A rubber dam-drain was inserted at lower part of J (in some a separate stab is best), flavine gauze applied, and limb splinted.

Of 13 cases so treated, 1 was in humerus, 1 in ilium, 11 in tibia. In 2 the cavity was very clean and no sequestra, hence preliminary operation was not done, no untoward result. In 6 there was fever of 100-101°. Locally inflammatory edema has been the utmost complication apart from stitch ulceration in old scars. Three healed per primam with no serous discharge; the rest had the usual bipp sero-pus for 1 to 3 weeks; one was reinjected with bipp on 2 occasions, the bone flap not being a good "fit"; sound healing was attained ultimately. The average time of complete healing was 24 days. In no case has necrosis occurred. The bony union was sound in every case but one in a month, as far as palpation could ascertain. In the case where reinjections were needed, union was delayed for 9 weeks.

R. S. Skirving[7] takes up *tunnels and large cavities in bone.* Their presence in bones as the result of gunshot wounds, as well as other conditions, is a common cause of persistent sinuses. Tunnels occur where a long bone has been perforated by a bullet and in treating the septic condition associated with these compound fractures, a drainage tube has been passed right through the bone, the bone uniting round a central cavity.

Attempts at sterilization of these cavities and tunnels by scraping and the use of disinfectants are in many instances unsuccessful. The most successful treatment was subperiosteal resection of one wall (access being gained by longitudinal incisions down to the bone), at r. angles to the length, so as to convert the tunnel into a groove or trough. The trough so made is drained through the more dependent incision and the bridge

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(7) Med. Jour. Australia, Aug. 23, 1919.

of soft tissues pressed down into the bone by fairly firm bandaging. The same measures apply in dealing with large cavities, one side being removed periosteally, so as to convert them into a trough.

In the treatment of these chronically infected lesions Bier's passive congestion is a good adjunct and Skirving also has considerable faith in the application of oxygen and ozone to the interior. This enables the granulations to live and proliferate and so to fill up the cavities, and this action is the more active if the walls fall in by the operation advocated.

J. Phillips[8] calls attention to a post-war problem—*the buried sequestrum*. This is associated with the extraordinary comminution in war fractures. The bone is commonly splintered into many fragments; the periosteum torn and separated; the spaces between fragments and between them and the periosteum become filled with new bone, in the midst of which lie one or more sequestra. These buried sequestra are responsible for the persistent suppuration.

The first figure shows a piece of femur removed in re-amputation after a guillotine amputation 9 weeks previously. Evidently the periosteum had been separated in the primary amputation and osteogenesis had resulted in a large loss of new bone. Had the case been left no doubt the piece of bone (*a*) would have become separated as a ring sequestrum. Some similar pathology may be found the explanation of myositis ossificans. This comes on after an injury, generally one affecting a muscle attachment to bone. If we imagine the injury has produced some separation of periosteum, it is not difficult to picture the osteoblasts becoming free to invade the damaged muscle and their subsequent conversion into bone cells. The second picture shows a mass of new bone removed from a femur of which there was a partial fracture. The man had been treated at another hospital from May, 1917, to February, 1918, and was then sent home on furlough. The wound broke down, and he was admitted to the War Hospital. A lump was felt in the femoral region which the *x*-rays showed to be a bony growth. An inch-long sequestrum

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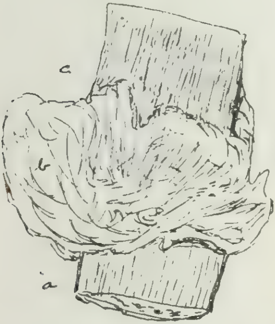
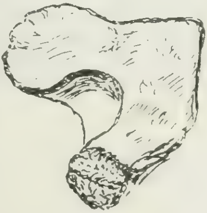
(8) Lancet, Feb. 22, 1919.

was removed from a granulation-lined cavity; the cowl of new bone had been thrown out over the sequestrum. The same rampant overgrowth of new bone takes place around a badly comminuted (gunshot) fracture. A femur may become two or three times its normal thickness; nor does a radiogram usually show the full extent of the enlargement, since many months are required before the new bone is sufficiently calcified to be opaque to the *x*-rays. It may be that sequestra keeping up a constant discharge are buried an inch or more deep in this mass of new bone. The difficulties in the way of localisation are very considerable. The persistence of one or more sinuses is, of course, a constant feature where there is chronic osteomyelitis. All his cases were *x*-rayed but the number and size of sequestra more often than not cannot thus be diagnosed.





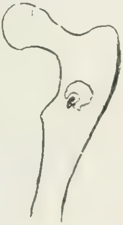


Fig. 52. Piece of femur removed in reamputation. *a*, protruding bare bone; *b*, epiosteal new bone, surrounded by scar tissue and muscle; *c*, normal bone.

Fig. 53. Piece of bone chiseled from femur.

Fig. 54. Location of same, it formed a cowl over sequestrum (Phillips).

The only treatment likely to be successful consists in baring the bone from overlying soft tissues and freely chiselling through until the sequestrum is exposed. This is severe, and, as multiple sequestra are not uncommon, more than one operation may be required. The removal of the necrotic tissue makes it possible to treat cases by the Carrel method; the wound can be made surgically clean, and secondary suture successfully practiced. The necessary chiselling of such a femur if undertaken in a man who has been absorbing toxins possibly for months, is likely to be associated with a good deal of shock. More than once Phillips has thought it wise to complete this stage at a later sitting. When every obvious crevice has been smoothed away with the chisel the soft parts are stitched *open* by passing one or more mattress sutures of thick iodined silk through muscles and then through skin some distance away.

A fracture of the shaft of humerus can often be most successfully treated in the manner described, but of course free incisions require to be carefully planned to avoid the nerves. Different treatment is required where the bone is subcutaneous or poorly covered with soft tissues—*e. g.*, the condyles of femur, shin, etc.

FRACTURES—GENERAL.

Some figures relative to the *comparative frequency of various fractures* were obtained by I. W. Brewer[1] during the demobilization of 10,287 officers and men. A total of 665 old healed fractures were found (64.7 per 1000).

Humerus	101
Colles'	98
Phalanges (fingers and toes)	73
Clavicle	59
Tibia	55
Femur	52
Pott's	40
Forearm	32
Metacarpal	32
Radius	31
Metatarsal	17
Ulna	16
Elbow	15
Fibula	10
Ribs	9
Tarsus	6
Scapula	5
Skull	3
Sternum	2
Lower maxilla	2

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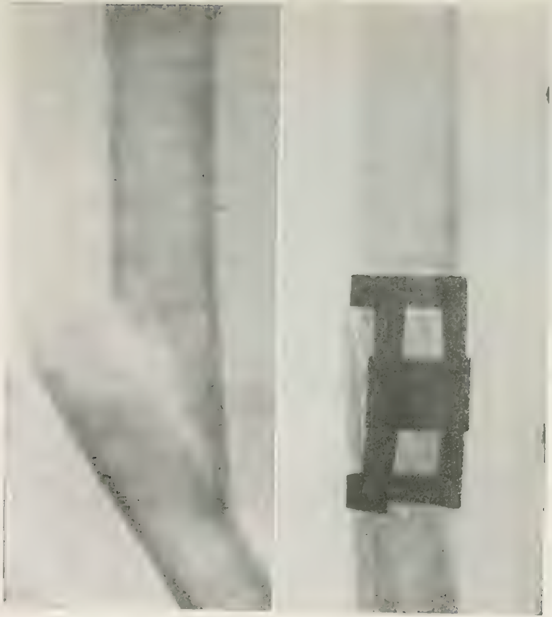
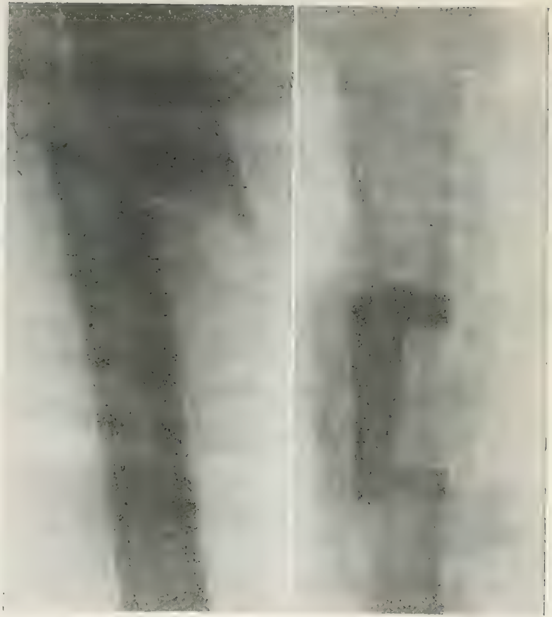
(1) Boston Med. and Surg. Jour., March 13, 1919.

PLATE III.



(Left) Woman, of 69, with fracture of lower end of humerus, admitted June 4. Band applied June 8.

(Right) Same case soon after application of band. Three months after operation had perfect functional result, band embedded in firm callus.



(Left) Girl of 7 with fracture of upper third of femur, July 3.

(Right) Two months after operation, callus enveloping band; perfect functional result. Collins. (See p. 200.)

Patella	2
Pelvis	2
Malar	1
Vertebra	1
Wrist	1

[This incidence may be compared with the enormous number (127,571) alluded to in the 1918 volume—p. 217. —Ed.]

In his consideration of *fractures as potential deformities*, M. S. Henderson[2] remarks that every fracture has within itself the tendency to leave varying degrees of deformity and disability in its wake. The fact that the treatment as a whole usually gives good functional results indicates the underlying mechanical principles are quite simple. In certain types, particularly near joints, deformities are especially prone to occur.

Following a fracture about the shoulder joint, the common disability is lack of abduction and external rotation; in the elbow, lack of flexion, and in the wrist there is the well known "dinner-fork" deformity with inability firmly to close the fingers. A fracture in the hip is prone not to unite unless adequate fixation is provided after the reduction. A supracondylar fracture of the lower femur or an epiphyseal separation interferes with the proper transmission of weight and limits flexion and extension. Pott's fracture is the common one of the ankle and not infrequently causes disability by the valgus produced by poor alignment for weight bearing

If the type of deformity that is apt to follow the particular fracture being dealt with is kept in mind, and if it is recognized that deformity is potential, better results will undoubtedly be obtained by vigorously guarding against poor alignment.

Delayed and Non-Union. An interesting *case of delayed-union* was cared for by A. A. Matthews.[3] Late in 1910, a child of 5, was referred on account of lameness. While there was no history of accident, the radiogram plainly showed a fracture of the fibula near the lower end, and the tibia was bowed. The deformity was corrected by fracturing the tibia, and removing a small por

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(2) Minnesota Med., May, 1919.
(3) Northwest Med., July, 1919.

tion of the fibula which projected against the skin; the tendo Achillis was also divided.

Not seen again until May, 1917, when *x*-ray showed a very decided bowing of tibia with a defect where the bone was broken 8 years previously. The ends of fracture of the fibula, which are rather pointed; no attempt at repair or union. At this time the leg was rebroken a little above the former place, straightened and put in cast. Sept. 25, plate showed tibia in excellent alignment with little or no repair, over 3 months since operation. The next plate, Jan. 30, 1918, shows little effort at repair. *X*-rays were frequently made, the last one Aug. 1 about 15 months since the beginning of treatment.

Everything possible was done to encourage union. She was placed on thyroid extract for a long time, also calcium salts, iodin and eventually on a mixed ductless gland tablet (B. & W.) continued for several months. All these preparations were tried for long periods, from a few weeks to months. It was suggested that thymus extract would be of some benefit, which she took in large quantities for a long time. Besides, she was permitted to walk with a crutch and later a cane, wearing her cast all the time, often removed and leg massaged.

At the area in which the primary fracture was made in the tibia there seems to be some absorption and softening of the bone. As this happened first of all when 5 years old, it hardly seems reasonable this defect should last so long. After removing the cast Matthews had a steel brace made with a joint at the knee, which she wore for a long time after there apparently was fair union. None of the *x*-rays show any evidence of callus. There are several brothers and sisters, all healthy. Wassermann of father and child negative.

The well-known *influence of syphilis in causing non-union* is shown by 3 cases placed on record by J. C. Rockafellow.[4] I. man, of 34, Lane plate on radius, no callus in 2 months. Specific infection 3 years previous was then admitted, and with mercury *per os*, union was complete in 4 weeks. II. man, of 26, Parham band on femur, no callus in 10 weeks. Syphilis denied and 2 Wassermanns negative, but a well-defined scar on glans

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(4) Med. Herald, 1919, p. 177.

was found, and calomel hypodermically led to rapid formation of callus. III. Woman, aged 58, extension applied to femur, no callus in 9 months. Two blood Wassermanns negative, but one from spinal fluid was strongly positive. Rapid improvement under mercury.

Technic. Molded plaster splints are recommended by J. A. Miller[5] for *compound fractures of the long bones,* where they are not seen for 3 to 7 days after the injury. His experience at an English war hospital was that many of these men can scarcely be touched without giving them the greatest pain, and the position of the limb must be changed frequently for comfort, while on the other hand, many who would otherwise have been confined to bed, have, in a comparatively short time, been up after the molded splints have been applied. These being made at the time of application, can be of any strength or shape desired.

For the arm 1 or 2 splints may be made, usually two, anterior, posterior or bilateral. They are easily applied and as easily removed after the plaster has hardened, and the arm or forearm is never out of immobilization. If the patient has but one wound, one of the splints may be bandaged on permanently, and the other removed at will. If there are wounds on opposite sides, first one splint may be removed, wound dressed, splint reapplied and held, while the other is being removed and wound dressed. This prevents absolutely the moving of the injured part, actively or passively. For the lower limb, 2 are also made. One posterior splint turns up at the heel, and is molded into the shape of the foot; the second is bilateral and goes round the foot like a stirrup up either side of the limb, internally and externally. The latter splint, when dry and hard, slides off quite easily, and the entire limb can be dressed on 3 sides, the posterior splint keeping the limb in position. If the wound is in the calf, the lateral splint can be made the permanent one, and the posterior splint the removable one; or, if necessary, the splints can be removed in turn, and likewise reapplied. The splints for the lower limbs have been of the greatest value, as the ordinary ones have sometimes been very trying to both patient and surgeon.

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(5) New York Med. Jour., Dec. 14, 1918.

It has often been difficult to make them fit accurately, and give the proper support at all desired points, without great discomfort. They have often to be padded, and this occasionally gives way, causing pressure sores, no matter how much attention to its careful adjustment.

In many cases of multiple wounds, one being a compound fracture of the lower limbs, it is most difficult, if not impossible, to dress all the wounds without turning patient on his side. This cannot be done in the ordinary way by putting up compound fractures of the lower limbs. Again all these objections are eliminated by the molded splints.

The wound is dressed, and the entire limb is bandaged with one thickness of flannel. The limb is measured for the splint, then a piece of flannel or muslin bandage, the required length, is moistened and stretched out on a smooth, long table. The bandages are soaked in warm water, to which salt makes the plaster harden more rapidly. Now starting at one end of the flannel, the bandages are laid down on this flannel (or muslin) from left to right, and back from right to left until the entire bandage has been used, and another is now used, if necessary, until the desired thickness is obtained. The plaster splint is now made; it is soft and pliable, and put on the limb lengthwise, while held in position. The splint is bandaged onto the limb by means of gauze bandage, being molded at same time. The second splint is now made and applied in the same manner. The limb is held in position by sand bags until splints are dry, usually about 15 min. The making of both splints and their application takes rarely over 10 min. Three-inch bandages are most useful. For forearm, 3 are usually sufficient for both splints, made long enough to immobilize elbow, and going down well onto hand. About 7 are necessary for fracture of the tibia and fibula, immobilizing both knee and ankle.

Carrel-Dakin treatment may be carried out, the tubes being brought out between the splints. The moisture will not materially injure the splints, or even if injured it is no great trouble to make a new set. Again, they materially facilitate massage being so easily removed.

The suggestion is made by B. F. Stevens[6] that *ice*

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(6) Jour. Amer. Med. Ass'n, Sept. 13, 1919.

tongs for extension can be easily improvised from a pair bought at a 10-cent store. The ends at *A* are cut off with a file, new ones turned in, and then sharpened with the same tool or, better, an emery wheel. They are strong enough to sustain a pull of 30 lbs. without bending. The opening at *B* is suitable for a wooden wedge placed after the tongs are adjusted, which will keep the points from penetrating the bone too deeply. Another at *C* will keep the tongs from becoming unfastened if anything should happen to the weight.

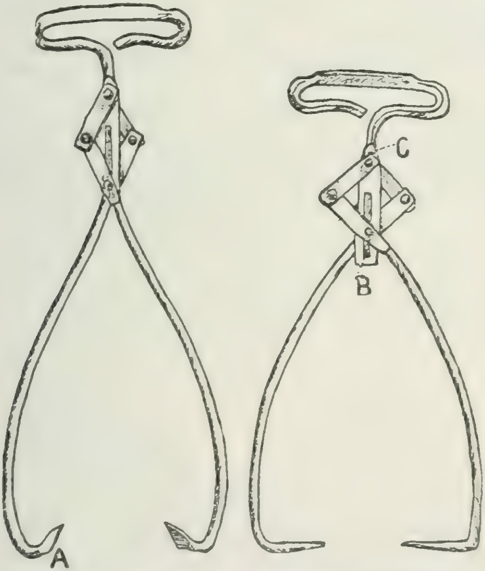

Fig. 55. Ice tongs for extension (Stevens).

A *new bone skid* is introduced by Witte and Schulz.[8] It has a short curved tip and a larger secondary curve in the opposite direction immediately following. Longitudinal grooves were cut into the second curve, as a guide for the roughened edges of the bone to slide in. The fracture is exposed, and if the fragments cannot be

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(8) Jour. Amer. Med. Assoc., Feb. 8, 1919.

reduced readily, the tip of skid is inserted beneath the overriding fragment so as to engage the edge of the fragment lying beneath it. The handle is then swung around so the edge of the overriding fragment glides in the grooves of the second curved portion, which then acts as the fulcrum to pry fragments apart. At the same time, the fragments are manipulated and guided by bone forceps so as to bring them into proper alignment. When this is done, the skid is removed, the fragments allowed to approximate, and fastened together. Since a tremendous leverage can be obtained, care must be used to avoid breaking out a segment of the cortex.

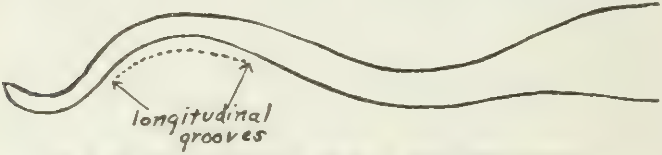

Fig. 56. Curved portion of bone skid (Witte-Schulz).

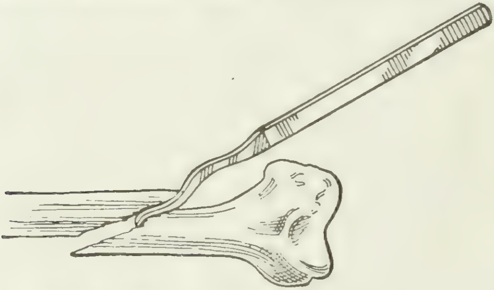

Fig. 57. Use of skid for bringing fragments into apposition (Witte-Schulz).

The *effacement of cavities in the treatment of fractures*, is discussed by Dehelly and Loewy.[9] In the figure representing a fracture with lateral displacement, the periosteum is seen very plainly bridging over each end, forming a more or less triangular cavity, formed on 2 sides by the bone and on the other by periosteum. These

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(9) Annals of Surg., April, 1919.

cavities become filled with blood which soon will be infected and the infection in turn will disturb the formation of new bone and the cicatrization of the ends progresses poorly. In these cases the extremity of the medullary canal does not become plugged and the vitality of the compact bone is diminished.

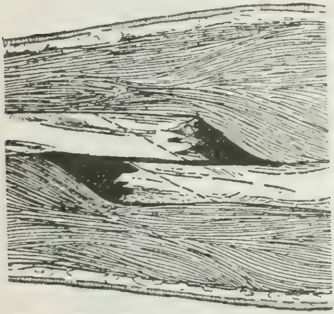
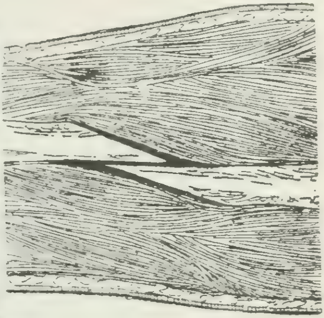

Fig. 58. Overriding fracture of femur showing proper operation.
Fig. 59. Same, after operation (Dehelly).

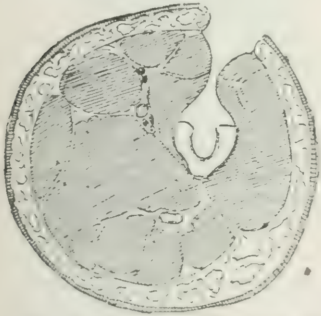
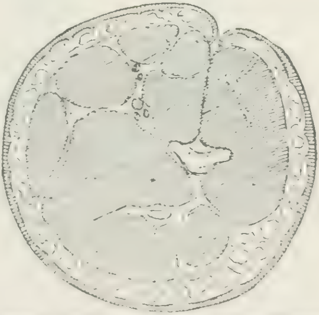

Fig. 60. Cross-section showing usual guttered femur (insufficient removal).
Fig. 61. Same, one quadrant remaining, proper removal (Dehelly).

The general rules of technic are: 1. The operation itself must not create a cavity in or near the bone. 2. Two overlapping fragments must not be cut perpendicularly to the axis of the bone. 3. When a long bone is guttered 3 sides must be removed.

The *Parham-Martin band* for holding fractured bones was illustrated in the 1917 volume (p. 217). H. F. McChesney[1] used it in 7 fractures (femur 3, tibia 3, clavicle 1) in patients of 34 to 70 with good results. He noted the amount of callus was comparatively small. Whether this is good or bad can only be determined by following a series of these cases afterward really to ascertain if a small callus would make a strong union. He thinks it will as long as the band is in position, because these cases after they are banded heal very firmly and one can pick up the limb, shake it and it seems to stay right in position. The bands are put on by a clamp which draws them tight. He tries to put them on subperiosteally and one reason for no undue callus is because there is as good an approximation of the periosteum as possible and then a layer closure, and the watchword is the absolute obliteration of space.

A *fenestrated band for fractures*, somewhat similar to the Parham band, is praised by A. W. Collins[2] after use for 3 years. It is meant for cases unsatisfactory with usual methods: I. V-shaped fractures; 2. long oblique; 3. comminuted, where many fragments are to be brought into apposition; 4. fractures near the joint.

To apply the band, first bend so as to pass around bone. The small end is pushed through first loop and then into instrument, where it is firmly held by a screw through a small hole in band. By turning the handle the band is tightened until the proper tension is secured, when it is immediately locked by simply pushing on the instrument, which automatically locks band by bending it on itself. The next step is to unscrew the instrument so as to cut off the band with a scissors about ½ in. from the bend, and then bend completely over with almost any blunt instrument. So far it has been used by Collins only on femur and humerus.

An alloy of nickel and silver promises the best results. Where they are to remain a greater percentage of nickel would be desirable, this metal is better tolerated by the tissues. The bands are being cut out of 24-gauge plate, and crossbars reinforced by a piece of same thickness.

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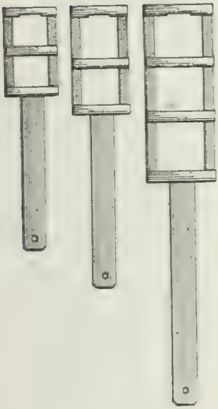
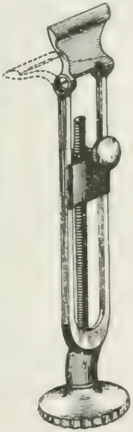
(1) Long Island Med. Jour., September, 1919.
(2) Surg., Gynecol. and Obstet., November, 1919.

For 6 months only one size has been used in all cases with but 1 window, it is so satisfactory that probably one size will meet all cases. (Plate III.)

Some animal experiments on *plates and bone-pegs* were performed by R. F. Fisher.[3] In the 12 platings there were 2 infections, and in practically every case the fractures healed satisfactorily. The plates and screws were firm and usually covered with fibrous tissue but never with true bone. In 4 to 6 weeks the callus was in great abundance usually on the side opposite the plate while after that it began to be small in amount so at the end of 11 weeks there was only a very slight amount at the fracture.





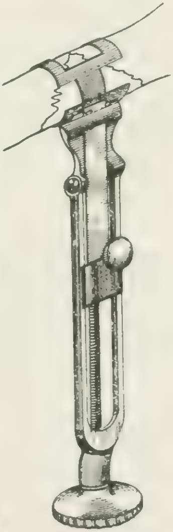


Fig. 62. Bands ready for application.

Fig. 63. Instrument used to tighten band by turning screw on end of band.

Fig. 64. When tight the band is locked by pushing on instrument which bends the tongue on itself (Collins).

In the experiments to study the reaction of bone and ivory, 3 small holes were made into the tibia, a small

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(3) Wisconsin Med. Jour., November, 1919.

ivory disc placed in one, a piece of boiled cow's bone and live dog's bone of equal size in each of the other holes. The animals were allowed to live 9, 10, 11 and 12 weeks, respectively. Careful study shows the ivory is healed in and is beginning to break up around its edges so probably it would have been absorbed had the animal been allowed to live. The pieces of bone seem to stimulate new growth and there is much more bone formation than around the steel plates. Good mechanical fixation with rigid asepsis are very essential for good results if plates are used in fractures. If operative treatment for malunion is required, bone graft, though more difficult, usually gives better end-results.

THE JOINTS.

Wounds. The *treatment of war wounds* is dwelt on by P. Duval.[5] The radical change that has taken place in the surgical treatment of these wounds is due to (*A*) the fact the joints resist infection and (*B*) the practice of operating as early as possible in the lines. The comparative results follow:

During 1914-15, in war wounds of the knee, the death rate was 27.6 per cent; during the same period amputation of the thigh was done in 30 per cent. During 1916-17-18, the death rate was 0.9 per cent, and amputation was done in 2.8 per cent. In 1914-15, a soldier wounded in the knee was generally sent either immediately to distant parts of France or operated upon at the army hospital, by simple arthrotomy and drainage; from 1916 on, such injuries were operated upon in the lines by complete surgical cleaning and immediate suture.

Immediate suture is based on the following principles: A wound of a joint, like any other war wound, is contaminated directly by germs which are carried into the wound by shot and fragments of clothing. Infection develops, but the defensive reaction of the synovial membrane is much more efficacious than that of other tissues; it seems to possess a bactericidal power. If a wound is

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(5) Surg., Gynecol. and Obstet., September, 1919.

examined bacteriologically in a few hours, the usual bacteria (aerobes and anerobes) are found in the skin, muscles, and aponeurosis. The tissues and the clothing contain a great number of bacteria. If the bones have been injured the surfaces of the fracture are contaminated and the edges of the torn synovial membrane are also contaminated, but the synovial fluid, the blood and serum are without bacteria. This aseptic state of the synovial membrane persists for a relatively long time—24, 48 and sometimes even 66 hours—before arthritis develops. There is then a long, intermediate period during which the joint remains aseptic while the parasynovial wounds are contaminated, even infected. It is in this intermediate period that operation should be done. On the other hand an appropriate operation permits the excision of all the contaminated tissues even the bone tissue, the resection of the contaminated edges of the synovial perforation, the removal of all foreign material—the bearers of infection—and it is after this has been done, *i. e.*, when the surgical wound and the joint cavity are aseptic, that complete suture without drainage should be done.

As to the limitations of this method, it is advisable to examine joint wounds, as to the interval since injury, and as to bone injuries which can be treated by preservation. Surgery may be applied, 24 or oven 36 hours after injury. Sometimes at this time, but often later, one may find a swollen knee which is painful and on incision, a suspicious liquid found on examination to contain bacteria, and few or no injuries to the bones. In such cases what is the best method to use? Joint drainage brings disaster. Even in these doubtful cases it is best to suture the joint. If purulent arthritis develops, early resection gives excellent results. Personally, in cases of arthritis with anerobic germs, Duval has obtained cures by injecting into the joint antimicrobic serum. Unfortunately we have nothing with which to combat the streptococcus.

During 1916-17-18 wounds of the knee were treated in the lines by total suture and express preservation. In 130 cases seen by Duval and his colleagues there were 21 immediate resections with 4 deaths; resection was not done in 104 cases. There were 86.5 per cent. complete cures, 9.6 comparative failures, 2.8 amputations, 0.9 deaths.

Osteocartilaginous Joint Bodies. M. S. Henderson[7] contributes his experience, as it was in the Mayo Clinic, the number is large—120 cases. These were removed from the elbow, shoulder, the knee itself and the bursæ about the joint (2 additional cases).

The origin is: 1. It is possible a piece of the joint may be knocked off by direct trauma. This, however, is rare. 2. It is well known that persons suffer from osteochondritis dissecans when the surfaces of the joint are especially brittle and some insignificant trauma causes the desiccation of a piece of the cartilaginous surface. He has never seen o. dissecans in any joint but the knee. 3. In hypertrophic arthritis marginal osteophytic growths may break off, wander about, and, nourished by the joint fluid, increase in size. 4. The synovial membrane may take on the characteristics of the joint surfaces, coming as it does from the same mesoblastic layer, and form first cartilage and then bone. This is preceded by hypertrophy of the synovia, which becomes pleated and pedunculated. The tips of the pedunculated areas become fibrous and later cartilaginous. As they increase in size, their weight causes small pieces of cartilage to drop off and become loose bodies. As free bodies, they are nourished by the joint fluid and may attain a very considerable size. They may become so numerous the joint is literally distended, and gives the feeling of a sac of marbles when palpated. 5. Occasionally a "Charcot joint" will have loose bodies but these are usually not true wandering bodies.

Knee. Of the 120 cases there were 49 of o. dissecans in which loose bodies were removed. Sixteen additional patients were observed who were thought to belong to this group but, for various reasons, operation was deferred. Some 28 presented the symptoms, subjectively and objectively, of loose bodies and showed positive radiograms, who were not operated on, but it was thought that the bodies were due to a hypertrophic arthritis. In cases in which hypertrophic arthritis was

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(7) Railway Surgical Jour., November, 1918.

thought to be the primary cause, 8 were operated on and loose bodies were removed; there were 4 of osteochondromatosis in which the synoval membrane seemed to be responsible for the osteocartilaginous bodies. Thus there was a total of 105 cases with loose bodies in the knee joint, in 61 of which operation was performed and the etiology established.

The symptoms produced by loose bodies are those of mechanical derangement; practically the only condition with which they may be confused is a torn or loose internal or external semilunar cartilage. The radiogram almost invariably clears up the diagnosis for, while the semilunar cartilages cast no shadow, the osteocartilaginous bodies do. The patient is usually able, at some time, to locate a loose body in the knee, although the position varies, whereas with a semilunar, the protuberance of the cartilage if there is any, always occurs at the same spot—the joint line of the ant. and interior surfaces along the int. lateral ligament. The locking by a loose body is apt to be momentary, with comparatively slight effusion, and pain and stiffness following; the opposite is true with the semilunar.

The treatment is entirely surgical. Often a single loose body or even more than one may readily be removed from the suprapatellar pouch under a local anesthetic. If between the joint surfaces the internal or external incisions may be used. Occasionally it is necessary to open through the popliteal space, making a careful dissection on account of the vessels and nerves, and to remove the bodies from the posterior compartment of the joint. For a general exploration and search for a number of loose bodies, the longitudinal incision down the front and splitting the patella in its long axis is the most suitable. The incisions may be prolonged up well into the quadriceps and down into the patellar tendon, and thus greatly facilitate the search for the bodies. After such an incision rest in a cast is necessary for 3 weeks. There may be formation of more bodies, but this is the exception.

Fourteen patients with loose bodies of the *elbow* were seen; one had them in both elbows. Ten were operated on. The condition was thought to be due to osteochondromatosis in 3, in 7 it was probably due to a hypertrophic arthritis. It is of interest that all these patients were men. The symptoms in the elbow are rather indefinite and this undoubtedly accounts for the infrequent diagnoses. A history of severe trauma some years before is often given, but it cannot be said the bodies are definitely due to trauma. Typical locking is rather rare. The common symptoms are limitation of motion, particularly extension, and an indefinite soreness. There is often a certain resemblance to a tuberculous history, but the wasting of the muscles is absent. Here, as in the case of the knee joint, the radiogram establishes the diagnosis. In the group of elbow cases there has been no one they could definitely assign to the o. dissecans group. In the majority, the condition was due to the breaking off of osteophytic growths from hypertrophic arthritis, and in some to a definite osteochondromatosis. If any treatment is necessary, removal is the only course. The incisions of choice are in front on either side of the biceps tendon or, if the bodies lie in the olecranon fossa, through the triceps just above olecranon.

One patient had multiple loose bodies in the *shoulder* and the symptomatology rests on that alone. The locking is quite transitory, and followed by pain and soreness. The locking may be so frequent the patient hesitates to use the arm, and the deltoid may be considerably atrophied, but by no means to the degree seen in tuberculosis or definite arthritis. The treatment is removal; the site of the incision to suit the individual case. In their case a posterior incision was used on account of the thinness of the capsule in that area, and the bodies, 10 in number, manipulated around to the opening and removed.

THE NERVES.

Technic. W. W. Babcock[8] found the *instrument for holding peripheral nerves* has greatly facilitated the suture of divided nerves and has reduced, in some cases, the actual time by one half. The halves of the instrument are pinned to the nerve .8 or 1 in. distal to pro-

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(8) Jour. Amer. Med. Ass'n, June 7, 1919.

posed resection. The nerve ends are then freed and sliced back by a razor blade until the section shows the desired fasciculi. By closing the arms of the instrument the nerve ends are apposed. After suturing the accessible edges of the sheath, the instrument is turned over and the rest of the sheath is sutured. The pins are now gently withdrawn and the instrument removed. After the instrument is applied, it should at once be tightened sufficiently to produce moderate traction. If there is a wide separation between the ends, the continued tension will cause the nerve to stretch. The instrument may then be gently retightened from time to time as the operation proceeds, thus reducing the gap. It should be made in at least 2 sizes. The grooves of the large instrument about $^1/_2$ in. and of the small about $^1/_4$ in. in diameter. It may readily be made from a pair of Star-

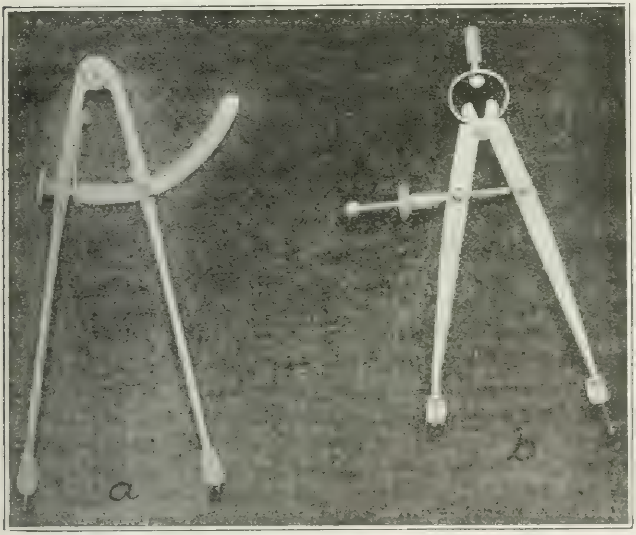

Fig. 65. *A*, nerve clamp, showing glass headed pins to fasten nerve to instrument. The milled screw is a fine adjustment; *B*, instrument made from Starrett calipers, by brazing perforated curved ends and short pieces German-silver tubing (to receive the pins) to the arms **(Babcock).**

rett calipers by brazing appropriate ends (*b*). For larger trunk the small, glass-headed, steel pins of daily use serve very well. For very small nerves very fine needles to which metal or glass heads have been fused may be used. It is somewhat more convenient to introduce the needles from the shaft side of the instrument. The instrument as illustrated (*a*) has a thumb screw at the left which provides a fine adjustment. If properly used the instrument should rarely tear out. The reduction in the handling of the nerve outweighs the slight damage by needle punctures. In over 100 divisions of peripheral nerves he found none in which an end-to-end suture could not be performed. For the larger gaps, it is of course necessary to flex or extend the adjacent joints and perhaps also to dislocate the nerve to a new location. A number of gaps of 4.8 in. of median, ulnar and sciatic, have thus been overcome.

Sargent and Greenfield[9] undertook an experimental investigation with a view to ascertaining which of the many materials in general use as *nerve sutures* was least likely to produce harmful reaction in the delicate tissue. They conclude while (1) plain thread or silk sutures give rise to no irritation, they are relatively unabsorbable. (2) "Plain sterilized" or "plain iodized gut" are of value by reason of their rapid absorbability, but their low degree of tensile strength and slightly irritating nature counteract these advantages. (3) "Japanese silkworm-gut" has great tensile strength, and in rate of absorbability and the reaction which it causes holds a place midway between (1) and (2). Chemical antiseptics should be avoided in all suture materials.

A plea for the *homogenous nerve graft* is made by E. W. Fisher.[1] In the majority of nerve divisions that have resulted from gunshot the ends are capable of approximation for suture. But there are quite large numbers in which approximation is not possible. The surgeon who has been confronted with the problem has failed to proceed further or has resorted to one of various illogical expedients.

Fisher saw no instance of recovered function where

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(9) British Med. Jour., Sept. 27, 1919.
(1) Ibid., April 26, 1919.

bridging with foreign material has been done, or where the ends have been connected by a wrapping of fascia. Cargile membrane, or vein. If Van Lair's experiments are to be relied upon, it is inconceivable how union can by such means occur. He found, as a result of excisions in animals, that where a space of 4 cm. was left between the ends no recovery occurred; with 2 cm., recovery did not occur for 30 months; with 1 cm. excision, recovery of function was delayed to 14 months; whereas in approximation and suture, recovery occurred in 8 months.

Wherever a nerve has been wounded and divided, completely or in part, palpation will reveal a neuroma, which means a mechanical and functional block, and his experience is that until this block is removed, function is not restored, in spite of massage, electricity, and other futile means over a period of years.

In view of the large number still with disabilities the direct result of sectional lesions it is fortunately proving by accumulating evidence that lapse of time should be no deterrent against successful suture. The longest period between section and suture of the cases Fisher observed was 31 months, a complete ulnar nerve division.

A nerve graft may be regarded as deriving vascularity and nutrition from capillary connections that must at once form, and as undergoing the same Wallerian degenerative change of its fibres, in common with all medullated fibres severed from their cells. The loose connective tissue which surrounds a graft is a natural safeguard against adhesion that is so commonly responsible for local tenderness, contracture, irritative phenomena, and pain. If a graft is to afford a normal channel for every separate axis cylinder growing from above it must have a sectional area as great or greater than the trunk itself. Any provision short of this will result either in a syndrome of dissociation, a partial recovery, or failure of any recovery. Such unsatisfactory results are to be seen from autogenous grafts for the median, ulnar, and musculospiral nerves when their continuity is re-established by segments of cutaneous trunks of small and disproportionate calibre. Homogenous grafts are obtainable from stumps operated upon for painful neuromata, and it is quite feasible that certain men would be donors to their comrades who remain disabled. Opportunity is also afforded when amputation is performed if disease does not contraindicate, but such is rarely available. It is possible nerve segments preserved in a cooling chamber might be employed with success.

It is the anatomic factor which counts above all others for or against a good result. And the anatomic factor is not confined to the nerve. The breach of the tissues becomes indiscriminatingly mended by an inelastic material, binding parts together which should possess free mobility, dragging and distorting them from their normal course, and fixing them. Fisher made it a practice to excise all adherent scars with the object of reconstituting disturbed anatomy and restoring the mobility and normal function of the various structures. The aching of scars in cold damp weather is real, from loss of the insulating fatty covering; the pain is true, and can be localized by careful palpation to fine neuromatous terminations of divided nerves. Contraction and extension of muscles, free action of tendons, and consequently joint movement, are compromised by adhesion. Nerves by implication evince not only disordered conduction, but distressing tenderness at the affected region, so that attitudinization and protective contracture maintain deformity that resists correction from fear of pain. Many so-called functional cases have in these conditions an underlying cause, a sufficient aggravant in susceptible subject being an adherent scar by the mere annoyance of its continued drag and pull. All these evils can be eliminated by excision of the scar, which, when an implicated nerve is approached, should be the route chosen rather than another elsewhere.

Details are then given of a rapidly successful case: A soldier, of 32, received a gunshot wound with fracture of r. radius, June 7, 1917. On Aug. 30, 1918, Fisher excised all scar tissue and freed extensor tendons. The median nerve with its scar tissue was excised for 4½ in., and the gap filled with a piece of the post-tibial from a patient (Wassermann negative) whose thigh was amputated at the same time. Oct. 14, a secondary bone operation (ulna) was done. The man soon expressed a feeling the hand was changed, that it felt alive. Tinel's sign was obtainable in the palm within 3 months' time. Early in February, 1919, the hand was in a state of good nutrition, had considerable practical use, and the man had resumed his trade as a skilled electrician.

Attention is called by B. Stookey[2] to the *futility of bridging nerve defects with flaps.* This has not been definitely supported clinically, as evidenced by a critical study of the reported cases. Experimentally it has been shown that flaps do not serve as conducting paths for the downgrowing neuraxes. Nerve flaps whether central or peripheral are merely degenerated partial nerve segments. Continuity and union of neuraxes does not take place at point of suture. To avoid fallacious deductions it is important to distinguish between the level of the injury to the nerve trunk and the level at which muscular branches arise. Abnormal communicating branches are not rare, particularly between the median and ulnar. Such anomalies must be taken into consideration in any careful study of nerve injuries. Judging from the level of the lesion, muscles may not be presumed paralyzed but should be so demonstrated. Total movements may *not* be offered as evidence of return of function. The action of *individual* muscles must be given. Reports of peripheral nerve injuries, to be of value, must be accompanied by motor, sensory and electrical findings. By the formation of flaps from the central stump a portion of the nerve from which neuraxes must grow is removed. Distal as well as central flaps may sever muscular branches. By reversing the flaps they are taken out of their field. Thus the down-growing neuraxes are prevented from reaching the muscles through these muscular branches, even were regeneration to take place.

The use of *veins for support of nerve suture* is advised by A. G. Brenizer.[3] The perineural stitch does not give an absolute end-to-end approximation, when the nerve is under tension. The transneural stitch may certainly overcome this gap, but this traumatizes the fibres. Again, if too many stitches are used the scar tissue is apt to be excessive.

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(2) Surg., Gynecol. and Obstet., September, 1919.
(3) Annals of Surg., October, 1919.

Veins large enough to cover any peripheral nerves, except sciatic, can be found near the site of suture, *e. g.*, median basilic and cephalic, and branches of saphenous. These easily stretch enough to accommodate nerve. The veins should be taken preferably with their sheath. By 2, 3 or 4 fine silk sutures, the vein is pulled over one end of the nerve trunk, the suture made, vein pulled over suture line. The vein is first stitched to the perineurium on one side of the suture and then, under stretch and at the same time forcing the nerve ends together, the other end of the vein is stitched to the perineurium, on the other side of suture line. This serves to draw the nerve ends together and put the strain on the vein and perineurium, proximal and distal to the line of nerve suture.

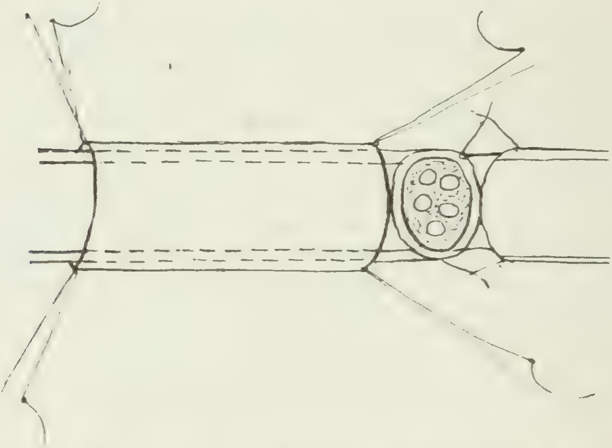

Fig. 66. Section of a vein investing one of the ends of nerve to be sutured, and about to be pulled over the juncture of the nerve ends when united end-to-end by perineural sutures. Four sutures, 2 at each end of vein, and 2 perineural stitches, piercing the perineurium of the ends. Traction sutures not shown (Brenizer).

In the same way, the vein, instead of a roll of fascia, may be used to span a gap between the two nerve ends. If several strands of sensory nerves, united into a bundle, are to be used to span the gap, the bundle is first drawn through the vein and both ends of the vein turned back on themselves. Then each end of the bundle is stitched to each nerve end and the ends of the vein are drawn, up and down, over the lines of nerve suture and stitched to perineurium, proximal and distal, respectively, to upper and lower junctions of intermediary sensory nerve bundle and the ends of nerve trunk.

A *technic for neurorrhaphy* is set forth by K. Bulkley.[4] The principle depends on utilization of scar tissue for the release of tension on the actual line of nerve suture. Most cases cannot be operated upon until some time after injury, when bony repair is relatively complete and sinuses and concurrent infection have ceased to exist. By this time repair has also taken place in the nerve, but almost invariably with resulting bulbous ends and nonunion of nerve fibers. It is these apparently useless fibrous ends which prove valuable. The illustration shows the method of use. The distal extremity is first isolated in normal tissue in the groove anterior to the supinator longus and dissected up until the divided extremity is completely separated from the scar tissue, care being taken to preserve attached to the nerve as much of this scar tissue as possible. The proximal segment of the divided musculospiral is then sought and its end treated in a similar manner. It is essential that both ends be sought primarily in an area free from scar tissue and that a quite considerable portion be freed. At times it will be most difficult to isolate

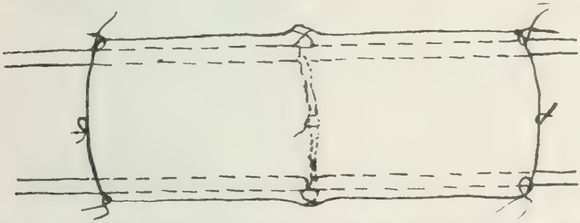

Fig. 67. Nerve ends joined end-to-end by perineural stitches, the vein drawn over suture line and then attached, proximal and distal, to the line of nerve suture, to the perineurium. All stitches are taken through long axis of perineurium (Brenizer).

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(4) Surg., Gynecol. and Obstet., October, 1919.

the proximal segment. If not readily found, a useful procedure is to make a small incision posterior to be brachial artery just below the free border of the great pectoral, where the nerve will be found posterior to ulna. Slight traction on it at this point will enable the operator to recognize it lower in the arm posterior or external to the humerus. Before anastomosing, it is well to make a new muscle bed which will separate the site of anastomosis and the contiguous portion of the nerve from callus. This is readily done by turning over a "trapdoor" of triceps about ¼ in. thick, and holding it with a few plain gut sutures. The field is then prepared for the anastomosis proper:

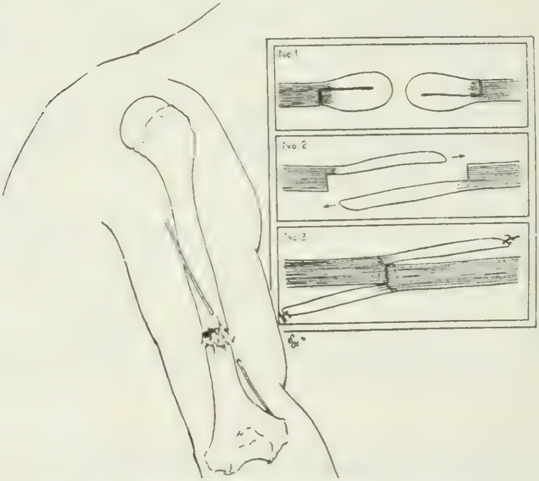

Fig. 68. Technic for neurorrhaphy (Bulkley).

At right angles to the long axis of the nerve and from opposite sides incisions are made almost but not quite through its thickness. These incisions should divide normal nerve tissue but should be placed as closely as possible to the scar tissue area (No. 1 in illustration). From the depth of each of these secondary incisions are made in the long axis almost to the extremity of the scar tissue ends, and the flaps turned back (No. 2). In this way 2 long flaps of tough tissue well adherent to the sheath are obtained for traction. The extremity of each of these is anchored, usually in neighboring scar tissue but occasionally in periosteum, in such a way the divided nerve fibers just meet without tension. He has used heavy chromic gut for these tension sutures. Care must be taken the nerve is not rotated. Three very fine silk sutures including only the sheath complete the neurorrhaphy. The suture line is covered with muscle and wound closed without drainage. The elbow is immobilized about 2 weeks in a posterior molded plaster splint at about 110°.

Diagnosis. C. A. Morton[5] makes some remarks on *diagnosis of gunshot injuries*, based on operative findings in 30 cases. Some illustrate what is of great practical importance, that in incomplete lesions all the signs of complete division may be present. The lesions usually found are either pressure of scar tissue or a localized thickening of the nerve itself. However, it is unwise to make a diagnosis that the division is complete entirely by the signs which are present, we should wait and see if improvement takes place. From some books we might conclude that if the "reaction of degeneration" were present, the lesion must be complete. But Morton several times had reports from medical electricians that paralysed muscles had this reaction, and yet those muscles have recovered. On the other hand, if there is faradic irritability, the prognosis as to recovery of the muscle certainly seems good.

But we may also make the opposite mistake and conclude that a complete lesion is incomplete, and go on with electrical treatment and massage for an unnecessarily long time, because we consider we have evidence of a certain amount of function. In one case there was an absence of anesthesia on the dorsum of the foot which made him think a lesion of the ext. popliteal was incomplete when the nerve had been completely divided. The mistake was inevitable, for there certainly should have been loss of sensation on the dorsum in complete division. But in injury of this nerve we may be led into errors by anatomies: These state the m. cutaneous and ant. tibial

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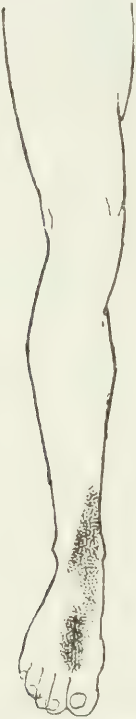
(5) Bristol Med.-Chir. Jour., July-August, 1919.

together supply the dorsal aspect of all toes, but the dorsal aspect of all but great toe is from plantar nerves (Sherren), so we must not expect anesthesia there even in complete lesions of ext. popliteal.



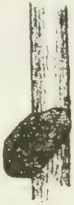


Fig. 69. Area of dark shading, loss of both epicritic and protopathic sense. Light shading, loss of protopathic sense only.

Fig. 70. Same case, incomplete division of ext. popliteal by shell fragment.

Fig. 71. Nerve after removal of metal fragment, showing laceration of the greater part of nerve. Arrow points to uninjured strand **(Morton).**

In one case of complete division of ulnar in midforearm, there was retention of epicritic (but not protopathic) sense on ulnar side of ring finger, and of palm. The latter may have been due to a very high origin of the palmar cutaneous branch, but the retained epicritic sense in ring finger suggested an incomplete lesion.

Morton in one case was able to corroborate Sherren's statement that division of the m. spiral below the origin of ext. cutaneous branches does not cause anesthesia in the "radial supply," as would be expected from anatomies, but this supply depends on the long ext. cutaneous branch of m. spiral, and the post. branch of ext. cutaneous which join the radial. The musculospiral was involved in a fracture of humerus. But in some other cases there have been areas of both epicritic and protopathic loss in some part of the "radial supply" and in these cases the ext. cutaneous branches of m. spiral and post. branch of the cutaneous were not injured. In one case a fragment of metal was actually lodged within the nerve, 3 in. above the condyle, and pressure on the foreign body at this level caused pain in the "radial supply" of the thumb and index finger.

Not only may we be misled as to the diagnosis between a complete and an incomplete lesion by the absence of anesthesia where we might expect it, but also by the retention of power to perform some movement which should be lost in complete division. Morton has twice been misled by this, in complete division of the ulnar, with persistent ability to adduct the thumb—not the false adduction (Sherren) due to action of either the long flexor or the extensors, but the true adduction he describes, and such movement as one can produce by electric stimulation of the adductor. In one case Morton was quite misled by the return of this action, and demonstrated to a class it was true and not false adduction, and that the ulnar lesion must therefore be incomplete. Yet the nerve was wholly divided. Another mistake which may be made between a complete and an incomplete lesion of the ulnar is that the f. carpi ulnaris is producing ulnar flexure of the wrist, when it is paralysed. Sherren considers the action is performed by the palmaris longus. But it has seemed to Morton to be due to a combined action of the f. carpi radialis and the e. carpi ulnaris. A knowledge of the substitution of the action of a muscle or group for a paralysed muscle or group is of great importance in the diagnosis.

Once the diagnosis of an incomplete lesion is made, one must not conclude that recovery is only a matter of time. Some of the fasciculi are completely divided, and only operation for reunion will lead to recovery. So this must be undertaken if there is no return of power or sensation after prolonged electric treatment and massage. Many are rather sceptical as to very rapid return of sensation after operation, but Morton had one undoubted return of epicritic sense in the median within 24 hours after freeing the nerve from dense scar tissue.

The *new sign for nerve regeneration* brought forward by Tinel—formication or tingling elicited by pressure—is corroborated by I. H. Coriat.[6] This test, when taken in connection with the return of electrical conductivity and selective sensory regeneration to which the latter called attention, forms a triad of signs which are very important from a practical standpoint, particularly in determining whether or not a nerve is spontaneously regenerating and thus postponing a projected suture, or in determining the actual success of a nerve suture.

Formication appears very early in regeneration, usually about 4th or 6th week, while the return of electrical conductivity is late and usually parallel with the return of voluntary movements. It is very important, for it indicates the presence of young axis-cylinders in active regeneration. The regeneration always takes considerable time, since under the most favorable influences, the axis-cylinders do not grow more than 1 or 2 mm. a day. Whether or not the formication sign can appear in defective regeneration leading to neuromata, can be determined only by future study. Regenerating axis-cylinders are spontaneously capable of traversing a certain distance due to the neurotropism of the peripheral end, but if the cylinders become blocked and wander in the cicatricial tissue which impedes the advance, it seems reasonable to suppose the formication will be limited to the area of neuroma and not radiate down the peripheral distribution. Here the formication will be felt only at the point of pressure and remain fixed there.

The test is very easily applied, but should be carefully done, as the tingling produced by neuroma forma-

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(6) Boston Med. and Surg. Jour., Aug. 7, 1919.

tion may lead to error. In neuroma formation or in the early stages of regeneration without neuroma formation, the formication is limited to the level of the lesion. In actual regeneration it progresses over the zone of the growth of the cylinders and can finally be detected along the partial or entire cutaneous distribution of the nerve. For a time it may involve the entire cutaneous distribution, but as regeneration becomes complete, it finally can be detected only in the extreme periphery. The exact cause is difficult to state, but since it can be produced by a far lighter pressure than formication in an uninjured nerve, it probably is due to an increased sensitiveness of the young cylinders. It is best, however, not to rely upon the formication sign alone. The test should be carefully correlated with the other investigations, *e. g.*, protopathic and epicritic sensibility, regenerating pain points, and electrical reactions.

End-Results. A series of *150 injuries of the peripheral nerves* was studied by J. L. Joyce.[7] There were 92 in the arm (ulnar 23, musculospiral 18, median 17, brachial plexus 13, median-ulnar 11, etc.). In the leg 54 (trunk of sciatic 18, ext. division of sciatic 12, etc.). Supraorbital 2, and cervical plexus 1.

The nature of the 90 operations was: Neurolysis (liberation), 39; delayed suture, 23; total exsection and suture, 6; Partial exsection and suture, 7; autogenous transplantation, 4; total exsection and autogenous transplantation, 1; homologous transplantation, 1; double lateral implantation, 3; exploration, 6.

Joyce is of the opinion neurolysis combined with "capsulectomy" (*i. e.*, removal of the thickened sheath) cannot be expected to effect a rapid cure except in pure extraneural compression.

In the 39 cases of neurolysis, there was complete physiologic interruption of the nerve without loss of anatomic continuity, but with no sign of regeneration in the segment below the injury in 17. Recoveries, 8; considerable improvement, 6; improvement, 3. The recovered cases comprise 2 ulnar, 1 musculospiral, 1 m. cutaneous, 1 post. interosseous, 1 sciatic, 1 post. tibial and 1 brachial plexus injury. The remaining 22 cases were performed

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(7) Annals of Surg., February, 1919.

either for incomplete physiologic divisions which were not recovering satisfactorily, or for the relief of pain, resulting in recovery, 2; considerable improvement, 6; improvement, 2.

In the majority delayed end-to-end union of a divided nerve is successful, and this method is that of choice. The anatomic continuity of a nerve deserves the greatest respect. Exploration of a physiologically completely divided nerve should be done as soon as the condition of wound permits. Nerve transplantations and double lateral implantations of the ulnar into the median have been followed with some success, including some recovery of voluntary power in the muscles, but recovery is slow and uncertain. Nerve growth takes place from both ends of a divided nerve and from both ends of transplants, but axis cylinders grow down only from the central end. An autogenous nerve transplant of smaller size than the nerve into which it is planted is capable of hypertrophy. Axis cylinders, judged by Tinel's sign, grow on an average 2 mm. per day. Perineural scar tissue constricting young cylinders is the most important factor in hindering recovery.

A study of *41 examples of nerve anastomosis*, at the Mayo Clinic, is made by A. W. Adson.[8] In all at least 16 months had elapsed since operation. There were 35 males, 6 females and the average duration of injury was 15 months. Some 73% have been under observation or heard from since operation. Seven injuries were associated with fractures, 1 with a dislocated bone, and 33 with lacerated wounds. Of the operations 80.5% were end-to-end anastomoses; balance 19.5% plastic operations of some sort. Sixty-five per cent. of the anastomoses were sutured with silk, 29 with chromic gut. Fascia alone or with silk and chromic gut in the form of a tube was used to protect the anastomosis in 49 per cent., vein in 10, and in 10 per cent. there was no covering. Some 73 per cent. of the anastomoses were in direct apposition, 27 per cent. presented gaps from ½ to 1½ in. long, average 1 in. The average time before improvement was 9.9 months and to reach maximum improvement 21.5 months. The average improvement obtained

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(8) Annals of Surg., August, 1919.

was 58 per cent. return of sensory, 62 of motor, and 67 of trophic function. Some 17 per cent. of the operations were total failures, and 9.7 gave indefinite results; 4.8 per cent. of all the wounds became infected.

It was found the degree of regeneration depends on (*a*) time between injury and repair, the shorter the period the greater the regeneration. The possibility is very slight after 3 or 4 years, (*b*) actual loss of nerve tissue, and (*c*) retraction of severed ends. In the technic (*a*) no covering is necessary if the freshened ends can be sutured in close apposition, (*b*) if an intervening gap remains it should be tubulized, preferably by fascia, (*c*) if the gap is over 2 in. tendon transplantation and arthrodesis should be considered instead of anastomosis; (*d*) autogenous transplants may be considered for short gaps, but are of no greater value than tubulization; (*e*) in all technic, the wound should be free from hemorrhage and infection, and the nerve ends not traumatized; and (*f*) during postoperative convalescence, the paralyzed muscles should be massaged and passive motion administered. (Plate IV.)

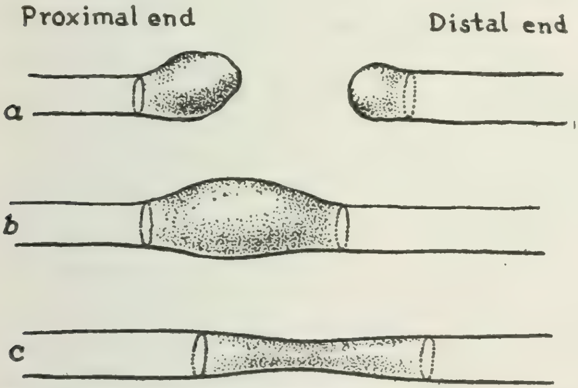

Fig. 72. Clinical findings in peripheral nerve injuries, (a) severed nerve with neuromas and the level of resection prior to anastomosis, (b) neuroma due to trauma without severance of the nerve, (c) constriction due to scar tissue or callus (Adson).

[The next three or four years will undoubtedly clear up our views concerning the prognosis following the various operations for the relief of injured nerves, because the thousands of operated cases in a dozen countries will furnish an excellent material for valuable observations.—ED.]

THE SCALP AND SKULL.

Scalp. Another case of total avulsion was treated by R. Durham.[9] As usual, the patient, aged 30, had her hair caught in machinery, Nov. 8, 1917. On admission, the scalp was found torn off entirely from the orbital ridges to the nape of neck, laterally including most of l. and part of r. ear, and midway down cheeks. Up to May 14 following, a series of 7 plastic operations and attempts at skin grafting were done, the scalp was a clean granulating surface, with a profuse discharge.

On this date Durham removed some Thiersch grafts by his method described in the 1919 volume (p. 127), removing of grafts simply by the application of iodin, and on the first day made a line of grafts which bisected area from one ear to the other and about 2 or 3 in. apart. These were held in place by a single layer of gauze and strapped down to the cheek. She would lie quietly in bed, so the drainage would be away from the grafted area, and nearly all the grafts took. June 4th, a second time this same method was used, and the head was divided into an anterior and posterior portion by grafts, so that there were 4 small areas left where previously there was one. These took very well also. June 22nd he filled in the posterior areas which were left, and during that period, while those were healing, she lay on her face and what drainage there was was carried away from this area, and on July 13th the final effort was made, and the anterior area was grafted. There were spots that persistently failed to form good grafts, and still a few where the skin is thin with a tendency to break down, but it is gradually becoming firm and the end seems to be very closely in view. The upper lids are contracted up,

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(9) Long Island Med. Jour., February, 1919.

and Durham was planning a little plastic work to allow them to close completely.

In the discussion J. M. Downey said in a similar case he tried to sew the scalp back into place and after about 8 days the entire scalp sloughed off. It has been recommended the scalp be replaced, but in doing so that the outer table be punctured in several places so as to establish a circulation between the scalp and the bone itself. It seems the procedure is worth trying. While the end-result was very good it took 4 months.

Skull. *A source of error in interpreting radiograms of the skull* is pointed out by S. Moore.[1] The semilunar shadow of Miller and Williams is identical with a like shadow found in a large proportion of all head plates made in the Washington University Medical School. This was first noted about June, 1917, when the method of making plates of the skull was changed by the employment of a then new plate-holder. The clue was furnished by 3 facts: That it was not observed in plates made by the method previously employed nor in single plates made without a plate-holder, and *was* observed in plates made with the plate-holder. The shadow has been found in all of the stereoscopic plates which can be described as technically good, in the 255 patients röntgenographed since the date mentioned. These cases varied from normal to the gross pathologic, and the shadow was shown consistently in all types of cases. There was occasionally found also another semilunar shadow, and still others circular in shape, all alike in *quality* to the one described by Miller and Williams. Considering the phenomenon from all aspects, one is compelled to conclude it is extremely complex, depending on the following factors and their interrelations, namely, the action of:

The direct rays from the tube modified after their passage through the skull; the "scattered" and characteristic radiations from the head; the "scattered" and characteristic radiations from the aluminum top of the cassette [plate-holder]. The "scattered" and characteristic radiations and coefficient of absorption of the same (arising from the superimposed substances) by the iron base of the cassette; these same properties in the air at the

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(1) Annals of Surg., January, 1919.

point where the plate is not supported by the iron base; and finally, the varying distances (in different planes of the head) traversed by the rays. However, the shadow is due to faulty apparatus, and of no clinical significance.

A clamp for osteoplastic craniotomy, described by E. Sachs[2] is applied as follows: The incision is outlined on skin as usual, and field draped. Two incisions, each not over .5 in., are made at the 2 ends, and carried down to bone. A staphylorrhaphy dissector, passed from one incision to the other strips up periosteum. One jaw of clamp is slipped through this space, the other jaw slipped into place, and screws tightened enough to control all hemorrhage; not too tight, however, lest they strangulate tissues. The clamps are of varying lengths and shapes to fit different heads.

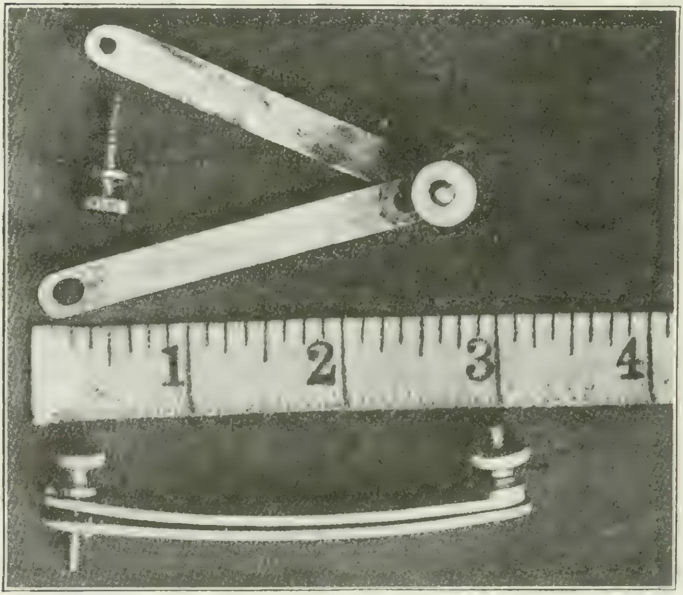

Fig. 73. Clamp for osteoplastic craniotomy—open and closed (Sachs).

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(2) Annals of Surg., July, 1919.

The dural separator and bone elevator for craniotomy, devised by A. M. Hanson[3] is shown nearly actual size. It is inserted in the dura, portions of the internal table are lifted up, and the instrument rotated between the thumb and forefinger, separating the dura from the internal table well beyond the margins of the opening made by the drill.

Years ago J. B. Roberts devised an *aseptic trephine* without the old-fashioned centre pin. He now showed[4] a new model recently made. It is in some respects not as satisfactory as the original made by hand, but large numbers of the present form can be made by machinery and at a much lower price. It does not need the stem which the instrument maker has put upon the drum which carries the centre pin. He also showed the *aseptic segment trephine* which does well in making clover-shaped flaps in resection for entrance to the cranial cavity when special saws like the Masland are not at hand. It and the various methods used to do osteoplastic sections are valuable now that surgeons always try to have bony closure of the gap in the cranial wall. The methods which depend upon cutting away with gnawing forceps the bone and leaving great openings to be closed only by fibrous tissue have become antiquated.

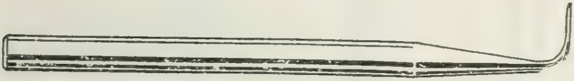

Fig. 74. Dural separator and bone elevator for craniotomy (Hanson).

Fractures. *Compound fractures* in which the dura has been torn and the brain traumatized have always offered a grave prognosis and operation has always been considered serious because of the possibility of meningitis or a brain abscess. Since the reports about the modern treatment of war wounds, especially since we have recognized the difference between contaminated and infected wounds, it seemed reasonable that these views which had been applied elsewhere in the body could also

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(3) Jour. Amer. Med. Ass'n, Sept. 13, 1919.

(4) Annals of Surg., February, 1919.

be applied to wounds of the brain. E. Sachs[5] was further encouraged by attempts to produce brain abscesses. Repeated attempts to infect healthy tissue with virulent organisms failed. It was realized that devitalized tissue was probably an important factor in brain infection. Suitable cases for this work are rare in civil life as compared to war wounds. In a large percentage of cranial war wounds with open dura, foreign bodies are lodged in the brain substance, while in fractures in civil life this is very rare. The injury, furthermore, in the latter type, is more apt to involve the cortex and subjacent area but does not extend very deeply. In 1917-8, Sachs advocated the excision of all traumatized scalp, dura, and brain tissue and replacing the defect in the dura by a transplanted piece of fascia and closing the skin completely without drainage. In 2 cases the results have been very satisfactory.

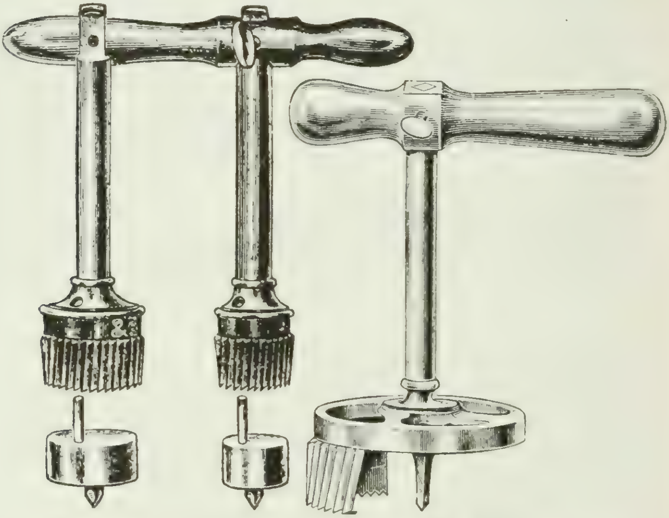

Fig. 75. Aseptic trephine, late model.

Fig. 76. Aseptic segment-trephine for making trefoil bone flaps in resection of cranium (Roberts).

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[5] Annals of Surg., January, 1919.

The *diagnosis of acute fractures* is considered by A. R. Wiley[6] founded on experience in Sharpe's clinic (N. Y.). The objects are: First and most important, the determination of the amount of intracranial pressure; second, localized pressure; third, the end-results of the present condition and how they will be altered by operation or other treatment. In the order of their importance as aids are lumbar puncture with the measurement of the pressure by a mercurial manometer whenever possible, the ophthalmoscopic examination of the fundi of the eyes, the pulse, temperature and blood pressure. The diagnosis is aided by a combination of history of accident, oozing of cerebrospinal fluid from the ears, nose or mouth, localized ecchymosis, paresis or paralysis, disturbance of reflex, the *x*-ray and other clinical signs. The ophthalmoscopic examination in the hands of a competent oculist is second only to the spinal puncture. The fundus and particularly the retina, being an offshoot from the brain, is most intimately connected with the brain and intracranial cavity, so any lesion within the cavity which increases its normal contents would naturally tend to be shown in the fundus, especially the nerve head. And an increased intracranial pressure sufficient to retard and even prevent the flow of blood in retinal veins would tend to cause a dilatation of these vessels with resulting edema and congestion.

The pulse is of importance, especially in the absence of other means. One of 48 or less with normal temperature or subnormal with other clinical signs, stupor, etc., demands a decompression. If there is fever present, that will be taken into consideration in judging the pulse. It is much better to operate on a declining than on an ascending pulse. The *x*-ray will show practically all fractures of the vault, fracture fissures, position of fragments, etc., but it will not show fractures of the base. It will aid in diagnosing some borderline cases, especially where one is unable by palpation to determine whether or not there is bone depression of a pathologic degree.

W. D. Haines[7] discussing *basilar fractures*, remarks that when one thinks of the numerous important struc-

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(6) Jour. Oklahoma State Med. Ass'n, April, 1919.
(7) Ohio State Med. Jour., May, 1919.

tures intimately associated with the base he can scarcely conceive a fracture here which would not involve extensive damage to veins, sinuses, arteries and nerves. Clinical recognition of such fractures depends largely upon the presence of escaping hemorrhage and cerebrospinal fluids from the mouth, nose or ear, and evidences of ocular and other paralyses.

Facial paralysis is fairly constant owing to the intimate relation of the 7th nerve with the auditory canal and the frequency with which the fracture extends through the petrous portion of temporal. Subconjunctival hemorrhage into the tissues covering the mastoid and nape are valuable occurring in conjunction with the other symptoms mentioned. A large amount of cerebrospinal fluid may escape through the nasal or auditory canal, but from a limited experience, Haines concludes that while it serves to clinch the diagnosis when present, one is not warranted in expressing a negative opinion because of its absence. The fluid may escape only after rupture of the dura complicated by open fracture, *e. g.* cribriform plate or those fractures involving the middle ear with rupture of the tympanic membrane.

The dura is so closely attached at the base as to render fracture without rupture of this membrane almost impossible and still such fractures do occur and it is for this reason that one must be guarded in assigning a proper place to the absence of cerebrospinal fluid in the scheme of diagnosis. Escaping serum, following hemorrhage arising from uncomplicated rupture of the tympanic membrane or nasal mucosa, may present in mimicry of this symptom and lead to a grave error in one's final conclusions. Notwithstanding the desperate conditions embodied in basilar fractures about 50 per cent., surviving the first 48 hours following injury, make a final recovery. The treatment should be directed to relieving shock, stopping hemorrhage, preventing infection and controlling pressure.

A. O. Wilensky[8] takes up *skull fracture with special reference to its neurologic manifestations:* In 5 years, 72 cases were admitted to Mt. Sinai Hospital (N. Y.). The great majority occurred in the first decade, the larger

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(8) Annals of Surg., October, 1919.

proportion in the second half of this period. There were three times as many in males. This preponderance among children is not extraordinary, since most of the cases resulted from street accidents, or falls into cellars or from the upper stories of buildings; both apt to operate much more commonly in children. The location was:

Frontal	9
Parietal	15
Fronto-parietal	6
Fronto-parieto-occipital	1
Parieto-occipital	6
Petrous and sphenoid	2
Temporo-parietal into middle fossa	1
Temporo-parieto-occipital	4
Parieto-mastoid	2
Middle fossa	1
Posterior fossa into ear	1
Basilar	1
Not determined or noted in history	23

Most have been simple fissures; of variable length, frequently involving more than one bone. The direction has usually tended to the vertical or oblique.

Abnormal neurologic phenomena were not always present; and in 34 cases no symptoms or objective signs could be elicited which would indicate any disturbance of neurologic function. These were practically always the mild cases, and among them one could distinguish the following: (1) Cases of scalp contusions or lacerations, with trivial or no symptoms and in whom fracture was originally not suspected but subsequently demonstrated by the *x*-ray in accordance with the routine custom of *x*-raying all cases of head injury of any kind. These made up the greater number of the "neurologically negative" cases. (2) Patients with such quickly disappearing symptoms that by the time they were admitted and examined, evidence of any disturbance of function could not be determined. All of these recovered, and, on discharge, their neurologic status was normal.

The remaining patients all presented some abnormality of the normal status. There were all grades of disturbances; some very mild and elicited only by examination; others in which the severity reached a maximum. The effects of these disturbances also varied; in some the abnormalities were transient; in a few the consequences persisted at the time of discharge. These effects were seemingly related to the pathology present; transient symptoms were associated with localized (relieved) compressions by bone depression or clot, or to temporary disturbances in the circulation, especially on the venous side; more lasting or permanent disturbances followed disorganizations of tissue due to the trauma or to changes in the blood supply, or to division of nerve trunks, or to unrelieved conditions (depressions, etc.) which would be apt to result in permanent conditions.

Of the 72 cases 22 died (31%); 18 were operated on and 6 died. The most important reason for the high mortality of the cases operated on is probably the nature of the original injury, or some extraordinary condition complicating it. Skilful operation under good conditions, does not add anything to the risk.

As regards the results from the neurologic standpoint, it seems: 1. That conservative and expectant methods, whenever they can be safely employed, yield the best results. They are unalterably opposed to operating indiscriminately upon every fracture of the skull. It seemed as the cases presented themselves they naturally fell into (*a*) A large group which always recovered spontaneously; (*b*) a smaller group, almost certain to die with or without operative treatment; (*c*) a very small group with such border-line evidence of intracranial damage as to make watchful expectancy advisable, but constantly in readiness to operate at a moment's notice; the final outcome was always doubtful. 2. Operation is imperative in every case showing advancing intracranial pressure. It should be done early, before there is evidence of medullary involvement. 3. Irritative or paralytic focal symptoms pointing to pressure upon or disorganization of definite cortical areas are the next most important indications. Isolated or irregular disturbances of neurologic function can be discarded and for these conservative treatment will yield superior results.

Late Results.—It has been possible to obtain reports in 13 patients. The periods of time since discharge average up to 2 years. Of these patients 3 were subjected to operation and 10 made spontaneous immediate recoveries.

Of the unoperated cases 2 are perfectly well and there are no signs or symptoms pointing to any neurologic disturbance. Three patients have generalized or localized headaches, and in 2 headache associated with dizziness: one has dizziness alone. These symptoms are not severe, make their appearance at rather infrequent intervals, and do not incapacitate in any way for routine work. One patient vomits occasionally; possibly from some temporary gastrointestinal disturbance. Epilepsy, either general or Jacksonian, has not developed in any of the patients traced. The 3 subjected to operations are 12 to 18 months later perfectly well and their neurologic status normal. The operative findings included a depressed fracture, an epidural clot, laceration of dura, and traumatized brain tissue; the bone depression was cut away, leaving an exposed area the size of a silver dollar; uneventful healing followed.

Cranioplasty. *The indications and technic* are taken up by Ch. Janssen.[9] There are 3 indications: 1. The restoration of external symmetry. Every loss of substance situated in the frontal or fronto-temporal region; every poorly-healed cicatrix; every loss of substance accompanied with marked depression comes under this category. 2. Prophylactic indications. To this class belong: (*a*) All cranio-encephalic lesions involving a loss of meningeal substance; (*b*) every cranio-encephalic wound which has healed by granulation; (*c*) every loss of substance 1.2 in. in diameter; (*d*) every loss of substance covered with thin and fragile connective tissue. 3. Curative. Under this heading come: (*a*) Such accidents as headache, vertigo, etc., if they are troublesome by their intensity or by their frequency, when the infectious cause of these can be certainly ascertained. (*b*) Accessory accidents, grave or frequent, which are not caused by the existence of an intracerebral body or by a hematoma.

Certain *contraindications* should be considered, such as: 1. The loss of substance; a relative contraindication which can be overcome by the adoption of some alloplastic proceeding. 2. The vicinity of the ventricles is not to be accepted as an absolute contraindication. 3. Permanent hypertension which does not give way to repeated lumbar

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(9) Annals of Surg., January, 1919.

puncture. 4. Every imbedded projectile which cannot be extracted, especially if not well-borne. 5. Every syndrome which suggests the existence of a latent meningeal or encephalic infection. 6. The presence of splinters which cannot be extracted at the time of operation.

Operative technic should have as its chief aim to do a prophylactic or curative procedure, esthetic and protective ideas being secondary. The objects are, therefore: To remove the adhesions between the skin, cranium and meninges, and the meningo-encephalic substance. To prevent the redevelopment of such adhesions. To remedy the cranial defect which exposes the patient to danger in case of new traumatism. The reëstablishment, as far as possible, of the external shape of the cranium.

In 13 examples of *repair of cranial defects by cartilage,* G. E. Wilson[1] states the following technic was used: After a tight-fitting layer of gauze has been placed over the prepared head, and an elastic tourniquet tied around the base of skull in the usual way, a flap of skin including the epicranial aponeurosis is turned down, which in certain instances is difficult owing to the close adhesion between the scalp scar and brain. The margin of the hiatus is then identified and the pericranium incised all around it at a distance of ¼ in. The pericranium is stripped up in both directions. The inner strip is freed to the margin and then the scar tissue adherent to the edge of the defect is likewise pushed inwards with a periosteal elevator until the dura is exposed. The latter is likewise freed for about ¼ in., so as to examine for thickening or spicules which might cause injury to the cerebral tissues. Any such abnormality is immediately dealt with. By an electrically-driven burr the outer table is removed for about ⅜ in. all around the opening, the object being to make a shelf upon which to place the graft and at the same time set free osteoblasts. When the bleeding has all been controlled the wound is packed with gauze, wrung out of hot saline, and while the assistant keeps up a moderate pressure the surgeon proceeds with the cutting of the grafts.

A vertical incision about 6 in. long is made 2 in. from the midline, splitting the fibres of the rectus abdominis.

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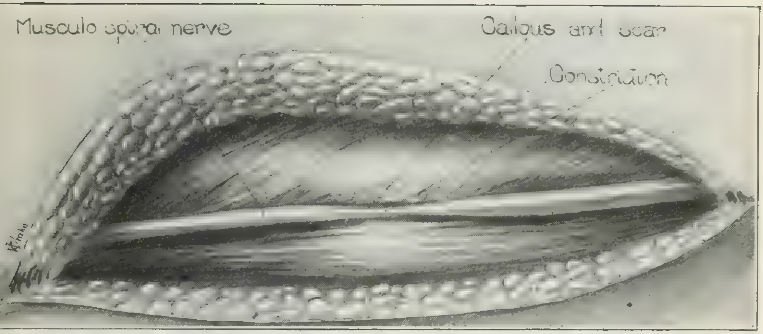
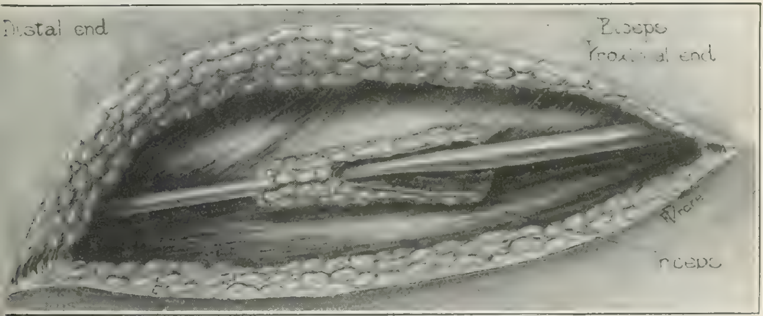
(1) Annals of Surg., March, 1919.

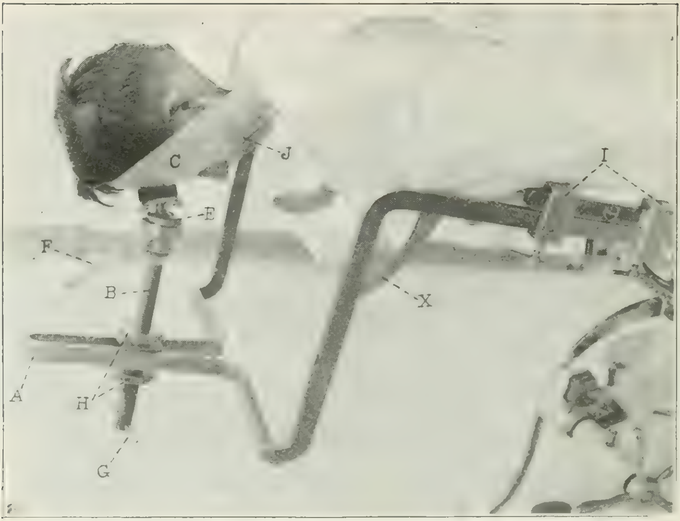
PLATE IV.



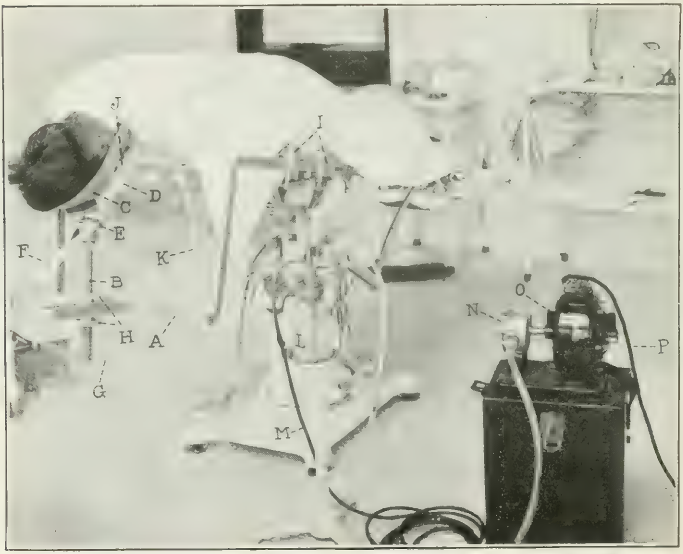
Exposure of musculospiral nerve, constricted by exuberant callus and scar, without complete destruction.



Covering the nerve with a fascial flap to avoid further constriction.—Adson. See p. 220.)

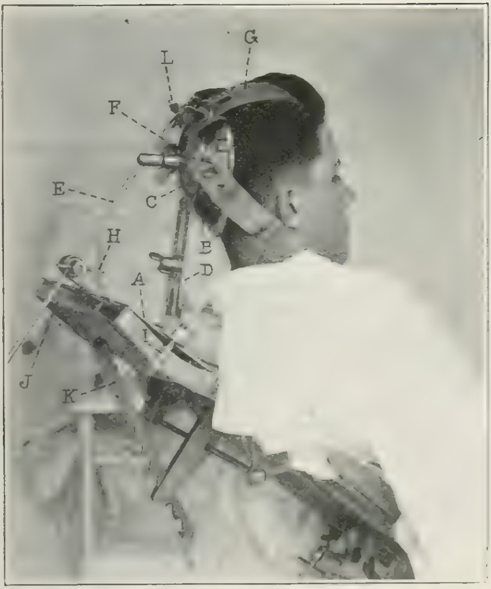


Cerebellar head rest: Head in position, with ether mask removed, exposing nose, mouth and chin.



Same: Rest in position, ether mask attached and connected with anesthetic machine and blower.—Adson-Little. (See p. 236.)

PLATE VI.



Ganglion head rest, showing attachment to swing leaf of Balfour table, with the various adjustments.—Adson-Little. (See p. 236.)

The muscle is retracted and the cartilages of the 6th, 7th, and 8th ribs exposed. If a larger graft is required the incision can be extended in either direction. Bearing in mind the size of the hiatus a suitable graft consisting of $\frac{2}{3}$ of the cartilages is removed. This is the most difficult part, for the graft must be uniform in thickness so as not to bend readily. Then the graft should be removed in one piece. When the opening is 2 by 1½ in. there should be no difficulty in closing it with one piece, but when larger the graft is roughly Y-shaped, and this must be so placed the three corners rest upon the skull. Unless the graft has a firm support the end-result will be disappointing in that the bulging on coughing remains. If properly done there will be no impulse. The grafts are immediately placed in warm saline, and when satisfied that sufficient cartilage has been procured an assistant closes the chest wound while the surgeon places the graft in position. Since the grafts take on a rounded shape with the convexity towards the cut surface, the smooth perichondrial side is placed next the brain. They are laid on the prepared shelf, and beneath the pericranium which is stitched to the cartilage by chromic gut. In a large defect it will be impossible to fill the defect with one graft, so additional pieces are suitably placed and sutured to the pericranium and the cartilage of the main graft. When all hemorrhage has been controlled the flap is stitched in place with silkworm-gut, a small drain inserted and the wound dressed with a fairly tight bandage. The tube is removed in 48 hours and stitches in 10 days.

[See also Morestin's paper (1916 volume, p. 109) for other uses for cartilage grafts.—Ed.]

At a meeting of the N. Y. Surgical Society, J. Douglas[2] made a report on a patient he had presented about 2 years ago. A young man on whom he had operated for Jacksonian epilepsy, due to a compound fracture of the skull; on account of the adhesions between the cortex and the dura he had dissected out the adherent portion of the dura and replaced it by *a flap of fascia lata* to which the fat was attached; this was inserted with the fat side adjacent to the cortex. At the time of presentation the

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(2) Annals of Surg., March, 1919.

permanence of the cure was questioned. The patient has since then been with the A. E. F. in France and Douglas read a letter from him stating he had no further convulsions since his operation.

[In the 1918 volume (p. 117) reference is made to other indications for fascial grafts.—Ed.]

Tuberculosis of Cranium. H. Roger[3] writes this is relatively rare. Pelletier (1910) was able to find but 210 cases recorded. But some authors each report from 10 to 24 cases, so it is less exceptional than seems at first. Two forms are recognized: Diffuse, progressive infiltration; and localized necrosis, the perforating form. The first of these forms vast foci invading the whole cranium. The author's case, in a Senegalese soldier, was a typical example of the perforating lesions:

The single perforation in the frontal was about 1 in. wide, the edges punched out. Externally it was completely covered by the periosteum, on the inside the edges were slightly adherent to dura. The débris in the opening contained no large sequestrum, the pia and brain underneath seemed normal. The adjacent bone was unaltered, no osteophytes, no wormeaten appearance as with syphilis. Occasionally the lesion is more extensive and may be 2 in. wide. The frontal and parietal are the customary seats, only about 10% invade the occipital.

This perforating form is an appanage of late childhood and adolescence, only 25% appear after 20. It is not an isolated and primary form. Nearly always there are other bacillary localizations especially osseous or osseo-articular. (Delmarre and Conor noted this association in 11 of their 15 cases.) Roger's patient, also, was admitted for spasmodic paraplegia due to Pott's disease of C. spine. At the necropsy other specific lesions discovered were a caseous nodule in r. lung, small tubercles in liver and spleen, one in adrenal, and pericarditis.

Symptoms are but slightly marked, pain localized at a fixed point of the vault, dull, increased by pressure, without exacerbation at night, often forms the whole picture. When the abscess forms and develops externally, the swelling may become more or less superficial and fistula

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(3) Presse Méd., Aug. 28, 1919.

appear. When the cranium is completely perforated, the pulsations of the brain may be transmitted to the abscess. In the endocranial form, there may be rarely signs of increased pressure and exceptionally localizing symptoms (hemiparesis or Jacksonian epilepsy). On account of this paucity of symptoms, the diagnosis is sometimes difficult. The absence of fever, the slow and torpid course, differentiate it from osteomyelitis with a more pronounced course. (Though there may be fever in such patients as Roger's where there are pulmonary lesions.) Osteosarcoma presents softened spots, irregularly scattered in the midst of indurated zones. Syphilis, which can be easily distinguished with the dry skull at hand, is often confusing during the course of the disease. It naturally occurs to mind, for it is the most common cranial affection. Syphilis is distinguished especially by its multiple lesions, several cup-shaped cavities, at the bottoms of which are large blackish sequestra keeping up an interminable suppuration. Headache is intense and persistent. The coexistence of other bacillary lesions (osseous or visceral) are a precious help in deciding for tuberculosis. On the other hand, a specific history or the Wassermann may turn the scale for syphilis. It must not be forgotten that tuberculosis and syphilis may coexist.

The prognosis of this form is grave, because generally accompanied by advanced visceral lesions which soon carry off the patient. As a rule, death is not caused by the cranial affection. So, if the process is limited to the vault or this is the most important, recovery may follow spontaneously, or more often after operation. As soon as the diagnosis is certain, intervention should be undertaken if the general condition permits. Puncture, removal of sequestra or other timid methods avail nothing, a free trephining is the best mode of preventing recurrence and insuring long survival.

[In these cases the careful injection of the sinuses with Beck's bismuth paste has given excellent results. This should be done once a week, care being taken to force the paste into every space by continuous, gentle pressure. In case of several external openings—which are common—the paste should be forced into the largest opening until it escapes from each one of the others in succession. The succeeding openings through which the paste escapes should be closed with the tip of a finger, until the paste has appeared through all the openings. —ED.]

THE BRAIN.

Technic. Adson and Little[5] describe the head-rests used at the Mayo Clinic:

The *cerebellar head-rest* serves 2 distinct purposes: (*A*) It holds the head prone so it can be tilted at all angles, thus giving good exposure of the cerebellum and cervical spine. (*B*) So arranged the jaw can be moved freely, the nose and mouth are exposed, and an adjustable mask can be attached to the frame to enable the administration of ether by the inhalation method without difficulty. The intrapharyngeal or intratracheal anesthesia is also made possible by removing the mask and inserting the catheter and attaching it to the anesthetic machine. The ether mask (*d*) is easily adjusted; it is secured in position by the curved edges, *J*. A short tube permanently fixed to the mask provides a means of attaching the ether tube, *k*. It also directs the ether toward the center of mask.

The *ganglion head-rest* is to prevent the head wabbling from side to side during operation. The head is held erect and may be raised or lowered or turned from side to side by the adjustable frame and universal joints. The base plate (*a*) is secured to the swing leaf, *j*, of the Balfour operating table by a clamp, *i*. The swing leaf may be adjusted by the ratchet bar, *k*. The headpiece, *b*, has a spherical surface adjustment in the cup, *c;* it is secured in position by the thumb nut, *f*. The spring fingers, *g*, are adjustable and hold the head in position. The upright, *d*, is hinged on *a* and supports *c*, which may be adjusted for height and angle positions through the rod, *e;* it is secured by fingers, *g*, to the headpiece, *b*. By adjusting the table, the swing leaf *j*, rod *e*, members *c* and *d*, swiveling piece *b*, and the fingers *g*, the head may be held in any position desired. (Plates V, VI.)

To *control hemorrhage from the large cerebral sinuses*, W. P. Eagleton[6] describes a device for obliterating the

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(5) Jour. Amer. Med. Ass'n, Oct. 25, 1919.
(6) Med. Record, Feb. 15, 1919.

cavities. A small opening is made in the dura, on each side of the sinus, using a triangular dural knife or cystotome. A ligature is passed from one dural opening to the other, using a full curved needle with the point blunted, damage to the cerebral tissue being avoided by hugging the dural surface. One side of the ligature is knotted in its center and the suture placed in the slot of the carrier and of the obturator of the same side. The other side of the ligature is then placed in the opposite slots, and, using the knotted point of the ligature as a fulcrum, is tightened sufficiently to cause slight indentation of the sinus; when the ends of the ligature are tied in a bow knot over the cross-arm of the carrier. Tightening the upper screw of the carrier will cause the descent of the obturator into the sinus, obliterating its cavity. Using an artery clamp, the slots in the soft metal arms of the obturator are then pressed firmly against the suture, holding it in position; the suture above is then loosened and removed from the slots of the carrier, and the obturator is liberated from the carrier by unscrewing the lower screw. (The suture may now be tied over the obturator.) If the ligation is to be made above the knee it will be necessary, in addition, to perforate the tentorium with the needle.

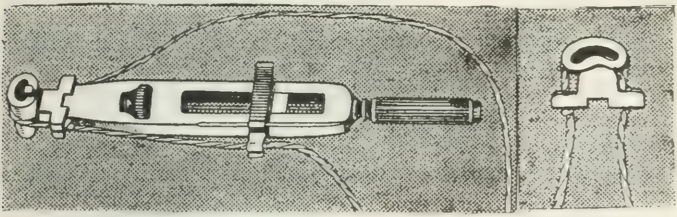

Fig. 77. Sinus obliterator: carrier with knotted suture in slots on one side and obturator attached.
Fig. 78. Same, obturator detached (Eagleton).

The upper portion having been obliterated, and all downward current of blood stopped, the lower portion of the sinus is easily ligated, as the sinus walls are here much nearer; or if the bony exposure is low enough, the lower portion of the sinus may be obliterated by the pressure of a tampon against its firm bony wall. Between the two ligatures the sinus can be incised. The obliteration of the sinus frees the approach to the anterior triangle of the cerebellar fossa, making possible the enlargement of the dural incision in front of the sinus. Through the enlarged triangle the whole of the inner side of the dura over the ant. surface of cerebellum can be inspected and the region of the adjacent cerebellum (the most frequent site of abscess) exposed.

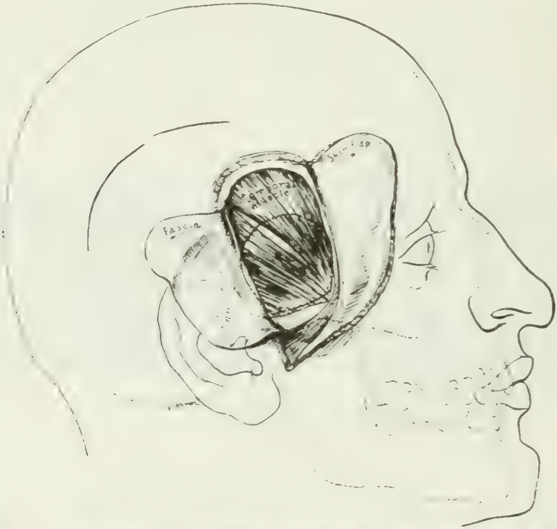

Fig. 79. Approach to Gasserian ganglion. The skin flap is turned forward, fascia flap backward, and temporal muscle split in direction of its fibers. The decompression following is indicated by the heavy dotted line (Adson).

Cutting the sensory root of the Gasserian ganglion for trifacial neuralgia, is treated of by A. W. Adson.[7] In operating in 10 cases of neuralgia in 1917, and in 28 cases in 1918, at the Mayo Clinic, two complications have attended the technic suggested by Frazier and Spiller: the occasional paralysis of the 7th nerve, and the trophic interstitial keratitis. When 7th nerve palsy occurs, it is

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(7) Surg. Gynecol. and Obstet., October, 1919.

accompanied by a lagophthalmos which, in turn, permits undue exposure and dryness of the cornea, resulting in abrasions and the formation of trophic ulcers. Interstitial keratitis may occur independently of paralysis of the nerve; it is very troublesome and may result in an opaque cornea. If these complications could be avoided, the operation could be recommended without any hesitancy to patients with neuralgia.

In an investigation of the probable factors involved in 7th nerve palsy, it was found (Hutchinson) the paralysis might occur as the result of detachment of the dura from the petrous bone, thus allowing the blood to enter into the small openings leading into the aqueduct of Fallopius; when the paralysis occurs, it occurs immediately. It may be only slight at first, but becomes complete within a day or two, as in one patient. It was present immediately after operation, progressed until complete, and then subsided, very slowly, during 6 months. The condition was also attended with trophic interstitial keratitis. A notation was made at the time that the dura had been stripped along the ridge of the petrous bone. Adson has had 4 patients with a 7th nerve paralysis, however, in whom the dura was not stripped from the bone. The technic was that suggested by Frazier and Spiller, in which the root was avulsed with a blunt hook. All of these patients were free from palsy until after the fifth day, when it came on gradually, became complete, remained for about 6 weeks, and then gradually disappeared. On avulsing the ganglion roots at postmortem, considerable trauma in

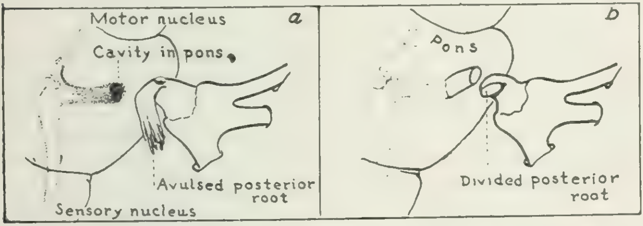

Fig. 80. *a*, Trauma produced within pons by avulsion; *b*, division of posterior root by cutting without causing trauma of pons (Adson)

the pons at the point of exit of the posterior root of the gasserian ganglion was noted. It seems probable that the cause of occasional 7th nerve paralysis is trauma resulting in small hemorrhages and edema of the pons and brain stem. This is further verified by the results obtained when the posterior root is cut and not avulsed. No paralysis occurred in 26 successive cases, since this change was made in the technic.

Decompression. G. A. Cathey[8] remarks of late years, *3 factors are responsible* for the marked decrease in the mortality of all cases of brain injury with or without fracture. They are, first, the determination whether the patient should be operated upon or treated by the expectant method; second, if intervention is necessary, then selection of the proper time to operate; third, the type and technic of the procedure.

The first factor is determined by the physical and *x*-ray examinations, revealing the character and extent of the fracture if present, and the amount of brain injury that may have resulted from depressed fragments. The degree and location of cortical pressure (the result of epi- or subdural hemorrhage and edema) are usually manifest by localized symptoms of paralysis or spasticity, and partial or total paralysis, if the motor area is involved. Most important are the character of the eye grounds observed with the ophthalmoscope and the pressure of the cerebrospinal fluid (manometer).

If the patient has recovered from primary shock or has even escaped it (and this frequently occurs), then we should be on the alert for the symptoms and signs of a marked increase of the intracranial pressure, which indicate intervention and those which counterindicate surgery. These are spasticity or paralysis, slowing or increase in the pulse (not below 50 per minute or a rapid increase up to 120 or more), increasing pressure of the cerebrospinal fluid to 20 mm. or over, and edematous blurring of the optic discs with enlargement of the retinal vessels, and also the presence of a depressed fracture of the vault. Operations should never be advised when patient is in shock or collapse, there is severe medullary compression indicated by a slow pulse and irregular

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(8) Northwest Med., November, 1918.

Cheyne-Stokes respiration and profound unconsciousness, nor when the pulse rate ascends quickly to 120 with shallow rapid respiration, which indicate medullary edema and collapse, and always terminates in death. Having determined that intervention is necessary, we should proceed as soon as patient has recovered from the primary shock or at least before he has been allowed to lapse into the fatal medullary edema.

The question now is, should we trephine and where, or do a subtemporal decompression? In all cases of brain injury, with or without a fracture, showing an increase in the pressure of the cerebrospinal fluid, we should first perform a subtemporal decompression to minimize the probability of medullary compression and possible edema, and then remove or elevate the depressed fragments, if present, at a later operation, within a week at least. The right subtemporal decompression with drainage is the choice in right handed individuals, for it drains the base as well as the vault; it is away from the motor speech area and exposes practically a silent area of the brain; the opposite holds good in left handed individuals. By virtue of the temporal muscle in this locality we are reasonably assured there will be no subsequent cerebral hernia or possible fungus, which often follow trephine operations in other localities when there is high intracranial pressure, causing a protrusion of brain tissue. In brain injury with or without a fracture but having a marked increase of intracranial pressure, the first operation should be a subtemporal decompression, which may be followed at later date by what operative procedure may be deemed necessary. Unless a depressed fracture of the vault, then the fracture in itself is unimportant so far as the treatment is concerned; it is more a question of the presence or not of a marked increase of the intracranial pressure. Whether that pressure is due to a hemorrhage or merely edema, the operative indication is the same. Very frequently at necropsies, in non-operated cases of head injuries and where no fracture was present, there was also no hemorrhage ascertained, but merely a wet edematous brain, sufficient to cause medullary compression and then edema, and thus death.

The *indications for subtemporal decompression* are set forth by W. Sharpe.[9] The 3 essential qualifications are: *A*. Presence of increased pressure. *B*. Removal of a large area of vault, usually 3 in. in diameter. *C*. The dura is inelastic in adults, no decompressive effect can be obtained unless it is opened, and if a permanent decompression is desired, then the opening must be allowed to remain open. The conditions as benefited by decompression may be classified briefly as follows:

A. Decompression alone.
  1. Brain tumors.
    1. Irremovable tumors.
    a. Large midbrain and basal tumors.
    b. Large subcortical tumors, the removal of which would produce grave impairments.
  2. Selected cases of cerebral spastic paralysis due to hemorrhage at birth.

B. Decompression and exploration.
    1. Brain tumors—non-localizable—usually in frontal and temporosphenoidal lobes.
    2. Brain abscess—non-localizable—usually in the temporosphenoidal lobes.
    3. Selected cases of organic epilepsy—Jacksonian in type or with increased intracranial pressure.

C. Decompression and drainage.
    1. Brain injuries with or without a fracture.
    2. Hydrocephalus.
    3. Brain abscess.
    4. Early localized meningitis especially due to otitic infections.

It is possible in rare and selected cases of cortical apoplexy alone, and at times in ventricular hemorrhage (although the diagnosis and operative drainage should be almost immediate in order to have the patient survive), that cranial decompression and drainage might be considered to obtain the greatest ultimate improvement, but to advise this operation for the internal capsular type, which occurs in 90 per cent—is most unsurgical; not only do these latter patients not have an increased intracranial pressure and therefore the operation described cannot be a decompression, but the damage resulting from the attempt to drain the hemorrhage (even if it would drain) would be far greater than by the lesion itself; besides, some of the patients reported have been operated upon

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(9) Surg., Gynecol. and Obstet., April, 1919.

late when no drainage would be possible; and even in the early cases, the hemorrhage is enmeshed among the capsular fibers and surely such hemorrhage cannot be drained. (Plates VII, VIII, IX.)

There may be selected cases of acute cerebral edema such as occur in uremia and certain other toxic conditions where, after medical treatment has failed, a decompression might be advisable to lessen a high pressure and thus to a certain extent, spare the vision and avoid a medullary compression and its resulting edema—always fatal. No cranial operation, however, should be considered until repeated lumbar punctures have been proven inadequate.

The cranial decompressions of choice are the subtemporal for supratentorial and the suboccipital for infratentorial lesions. Naturally, the subtemporal as a decompression alone is of little or no benefit for infratentorial lesions and should never be used in such conditions unless for ventricular drainage. Cerebellar tumor and abscess, *e. g.*, are always more effectively treated by suboccipital decompression, exploration and drainage.

The advantages of subtemporal decompression are: 1. It exposes, as widely as necessary, a comparatively "silent" area of the brain, the temporosphenoidal lobe, and therefore any damage to the cortex will not appear clinically; also, in patients having a high pressure the danger of a hernial protrusion of a highly developed area with resulting paralysis, etc., cannot occur. 2. Being situated midway between the frontal and occipital lobes, it permits careful exploration of all parts of the ipsolateral hemisphere; ventricular puncture is also possible. 3. It exposes the area of the middle meningeal so frequently injured in the traumatic cases, and also affords excellent drainage to the middle fossa at its lowest point—a very important factor in brain injuries. 4. A firm closure of the opening is obtained by the strong temporal muscle and its overlying fascia with their strong attachment to the parietal crest *intact*—a most important requisite in patients having a high intracranial pressure; hernial protrusions with their frightful fungi are most rare. 5. Technically, the operation is less difficult in that the opening is made through the thinnest portion of temporal bone. 6. The vertical incision is preferable to the former curved one in that it renders more possible a careful hemostasis of the scalp by means of manual pressure—traction and the clamping of the main branch of the temporal at the very beginning of the operation, whereas the curved incision passes through the various branches of the vessel in the scalp and they must be clamped individually; again, the vertical incision not only permits drainage at the lowest point, but it makes possible a large subtemporal bony opening without loosening the attachment of the muscle and fascia to the parietal crest, and thus a firm closure with no danger of hernia is assured. 7. The great frequency of temporosphenoidal lesions, *e. g.*, tumors, abscesses, and brain injuries make this subtemporal decompression a most important aid in underlying subarachnoid lesions.

Gunshot Wounds. D. Y. Roberts[1] removed a bullet from the brain of a woman, aged 36, some 15 months after injury. The patient had three marked convulsions, the first about 2—the second 6—and the third 10 months following the injury. These were typically epileptic, with a pronounced aura, and followed by a stupidness and sleep for several hours. During the intervals she had numerous vague sensations of an anesthetic type of the r. arm, which at other times was of a hyperesthetic nature. The condition started in the tips of fingers and gradually progressed along arm, although at no time did she lose control of her arm, excepting in the 3 convulsions. She was more or less troubled by fullness in the head, which at times became a severe pain localized over l. parietal area and sometimes over occipital region.

X-ray revealed a bullet just beneath skull on right about 1 in. above the petrous portion of temporal, showing missile had passed entirely through brain and lodged on opposite side. There was also a round shadow on left in almost same location, except about $\frac{1}{2}$ in. higher. Extraction was accomplished with the index finger with only slight disturbance of the brain tissue. No attempt to suture meninges. A gauze pack was inserted in a manner similar to that of the other side, and the flap also likewise approximated. The patient up to time of dismissal from the hospital had shown no evidence of

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(1) Railway Surgical Jour., April, 1919.

a convulsion nor sign of paralysis or anesthesia of the previously affected extremities. Her pupils responded equally and well to light, but rather poorly to accommodation. There was considerable deafness on right but practically none on left.

MM. Glénard and Aimard[2] had a curious case under observation: *traumatic aerocele of brain.* An officer was shot through head, the very small orifice in midfrontal, with enormous exit in l. temporal fossa. After the wound healed cerebrospinal fluid escaped from l. nostril, a radiogram taken 2 months after wound, showed a large collection of air in l. frontal lobe. The escape of fluid continued for about a month, then stopped. Injured May 30, he survived till Nov. 20. Necropsy disclosed a large hydrocele of the l. frontal lobe, which had followed the stoppage of the flow, and been preceded by filling of the wound cavity with air from frontal sinus.

[For another case of traumatic aerocele, see 1917 volume, p. 244.—Ed.]

A *series of cases* was treated by J. A. Wilson.[3] Of 5 in *frontal area,* the lesions did not involve the asc. frontal convolution, the motor area. Two of them had some loss of brain substance, without much, if any, loss of intelligence. Two had mental symptoms, and one had fits; but the latter were probably hysterical. Lesions of this area do not seem to produce any very definite manifestations. In 13 over *parietal area,* 11 had fractures but in 2 only was the dura opened. Five had motor paralysis, one became mentally depressed, and one developed Jacksonian epilepsy. All recovered, but some may develop epilepsy later on. Several patients, who had fairly large openings in the skull, had thin plates of silver or aluminum inserted under the scalp to cover the hole. Several injuries to temporal bone were associated with traumatic deafness or injury to the facial nerve. Injuries in the *occipital region* lead to disturbed vision and the chart shows a typical instance.

There were 3 cases of *hernia cerebri*—over the frontal area, over the parietal, and over the occipital. These

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(2) Presse Méd., March 10, 1919.
(3) Glasgow Med. Jour., May, 1919.

were sponged with spirit or covered with bismuth paste, gradually shrank and disappeared. The parietal one was associated with hemiplegia, but after 2 months patient could walk with only slight impairment of function. The one over occipital was associated with permanent hemianopsia.

Two cases had small *foreign bodies* in the frontal lobe: in one case they entered through the frontal bone and in the other through the occipital. They did not seem to produce any ill effect. Another man had a piece of metal in the parieto-temporal region. It formed on the radiogram a shadow nearly ½ in. square. It had entered through the occipital bone, injuring the visual area, and it had been in brain for 2 years. He had no paralysis. His mental condition was sluggish and irritable, and occasionally he was giddy. He got about fairly well. In another case a small piece of metal entered in front of l. ear, and the radiogram

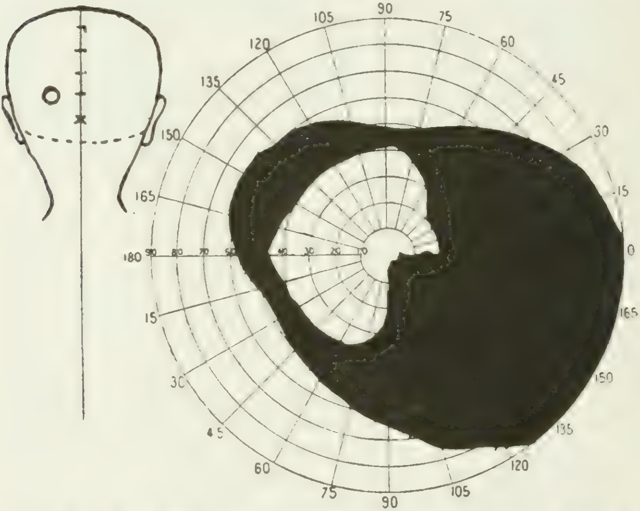

Fig. 81. The black area indicates the average normal field of indirect vision; the white inset shows the right field in Case 7. Above location of entrance wound (Wilson).

showed it lying in the under surface of occipital lobe. The shadow was about $\frac{1}{2}$ by $\frac{1}{8}$ in. It produced no observable ill-effect whatever. The absence of suppuration and the toleration of the brain seem remarkable.

In his *observations on gunshot injuries*, K. W. Ney[4] remarks that in the French service (1915) because of failure to appreciate the importance of early wound excision, the evil effects of drainage, and the possibility of primary suture after excision, operative mortality in these brain injuries so long remained above 50 per cent. Patients having brain injuries of this nature die usually an anatomic death within the first 24 hours, or, escaping this, die an infective death after 6 to 10 days, or even after many months; and to the prevention of these sequelæ attention was directed.

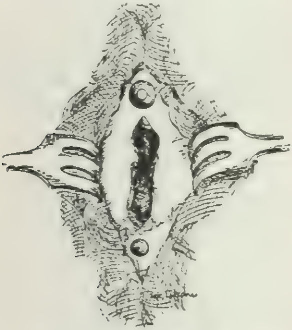

Fig. 82. Perforation of skull.

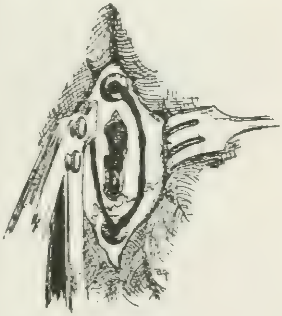

Fig. 83. Excision of bone lesion *en bloc* (Ney).

The procedure used chiefly at that time was the enlarging of the scalp wound for drainage and exploration, or it was made the centre of a large osteoplastic flap. In either case the devitalized soft parts were not removed and only the more superficial bone fragments and foreign bodies picked out. Little attention was paid to subdural adhesions, which in the endeavor to complete a speedy operation were often torn, thus opening the subarachnoid space to infection.

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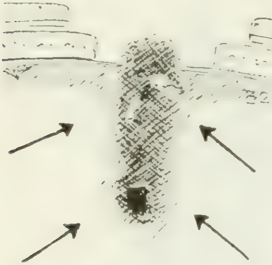
(4) New York Med. Jour., Aug. 9, 16, 1919.

With greater experience in the treatment of infected wounds it was learned that if the devitalized tissue could be excised early enough, it would be possible to eliminate most of the infection, and gradually these two principles—early and complete excision—found their place in the treatment of cranial injuries in so far as scalp and skull were concerned.

Ney's experiences with extensive traumatisms in which there was such great destruction of brain tissue convinces him the brain may be invaded to the extent of removing entire lobes with but little reaction. The unsatisfactory immediate results which so often attend cerebral operations is due rather to the anesthetic than to the intracranial manipulations. Local anesthesia is more satisfactory, and its value in avoiding shock and hemorrhage cannot be over-estimated. The anesthetic used is a 1-per cent. novocain solution, to which is added a 1:1000 solution of adrenalin chlorid, in the proportion of 15 drops to 30 c.c. of the novocain. It is desirable to use always a fresh solution of adrenalin.



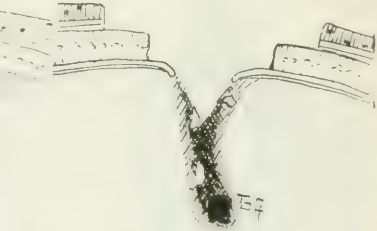
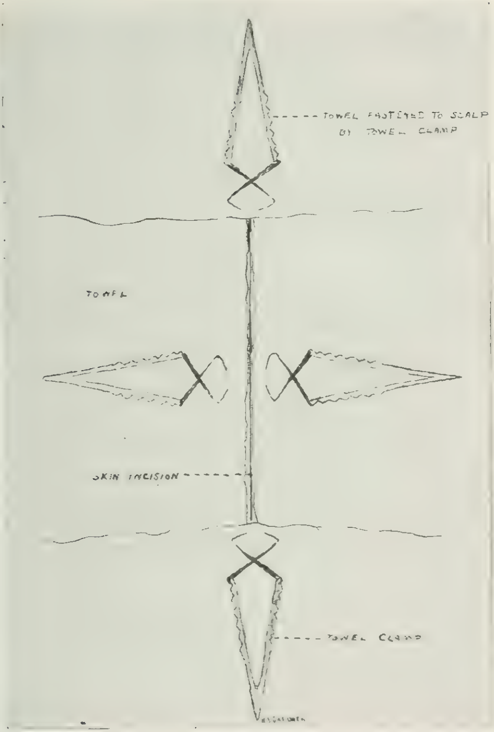


Fig. 84. Disorganized brain substance before removal, foreign body and bone fragments retained.

Fig. 85. Area of trauma after destroyed brain tissue has been expressed by patient coughing or blowing (Ney).

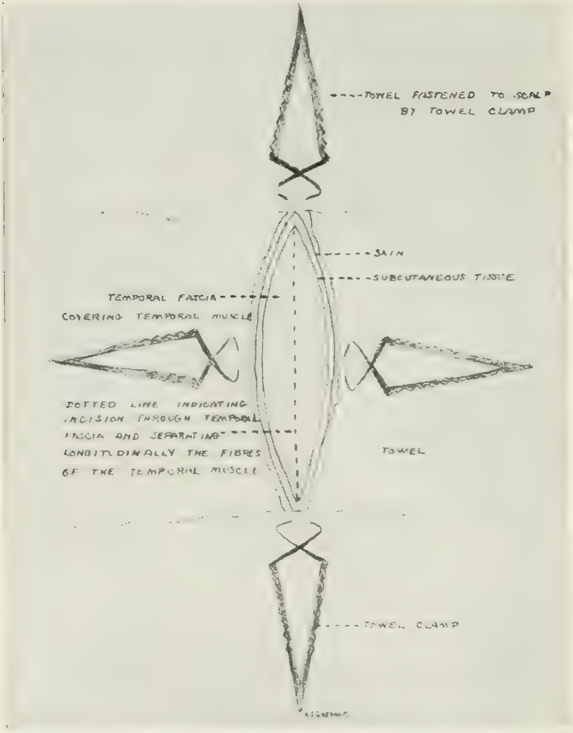
Observations were made in 79 cases in which operation had been performed, of which records, more or less complete, were kept with the neurologic and operative findings. While this series comprises cases of all degree: 22 were considered to be of a less serious nature, com-

PLATE VII.



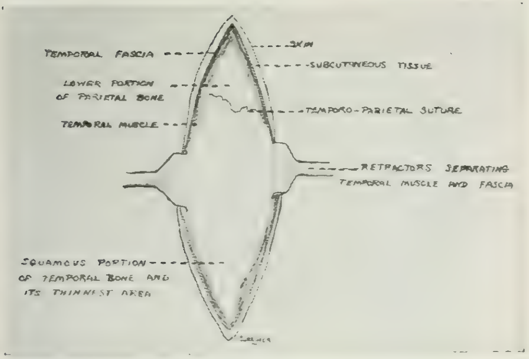
Method of covering skin (and lessening danger of infection) by clamping towels to skin itself; a wider exposure of skin is not only not necessary but dangerous. The lobe of ear cannot be made surgically clean.—Sharpe. (See p. 241.)

PLATE VIII.

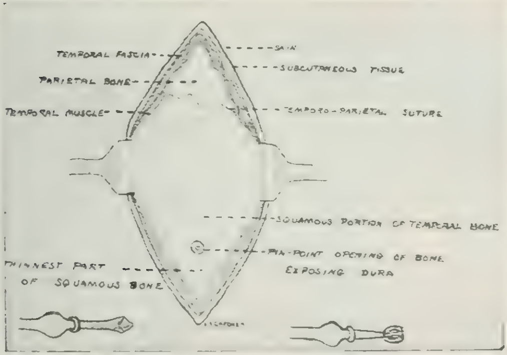

TOWEL FASTENED TO SCALP BY TOWEL CLAMP
SKIN
SUBCUTANEOUS TISSUE
TEMPORAL FASCIA COVERING TEMPORAL MUSCLE
DOTTED LINE INDICATING INCISION THROUGH TEMPORAL FASCIA AND SEPARATING LONGITDINALLY THE FIBRES OF THE TEMPORAL MUSCLE
TOWEL
TOWEL CLAMP

Skin incision down to temporal fascia. By manual traction-pressure on edges of scalp incision, bleeding is practically nil; small curved hemostats are now attached to subcutaneous fascia, and any possible bleeding points compressed by the hemostats being turned down.—Sharpe. (See p. 241.)

PLATE IX.

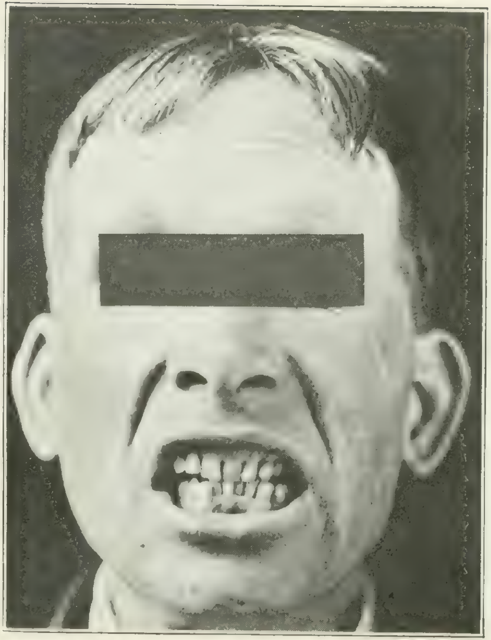

TEMPORAL FASCIA
SKIN
SUBCUTANEOUS TISSUE
LOWER PORTION OF PARIETAL BONE
TEMPORO-PARIETAL SUTURE
TEMPORAL MUSCLE
RETRACTORS SEPARATING TEMPORAL MUSCLE AND FASCIA
SQUAMOUS PORTION OF TEMPORAL BONE AND ITS THINNEST AREA

Retraction of temporal muscle and fascia exposes lower portion of parietal and squamous portion of temporal, for an area of 3 in. in diameter.

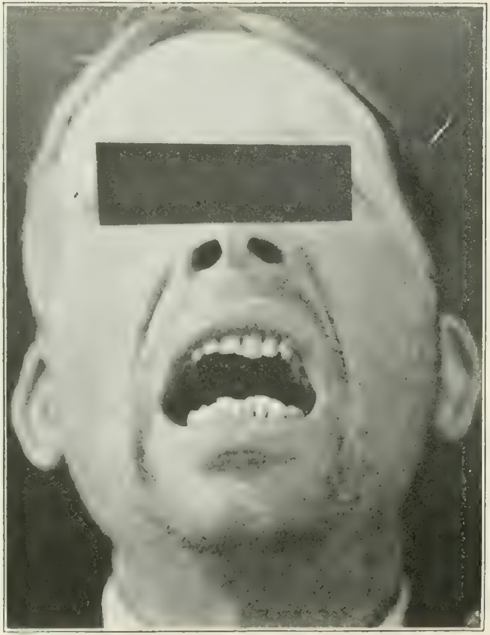

TEMPORAL FASCIA
SKIN
SUBCUTANEOUS TISSUE
PARIETAL BONE
TEMPORAL MUSCLE
TEMPORO-PARIETAL SUTURE
SQUAMOUS PORTION OF TEMPORAL BONE
PIN-POINT OPENING OF BONE EXPOSING DURA
THINNEST PART OF SQUAMOUS BONE

At the thinnest part of squamous bone the perforator is used to make a pinpoint opening down to dura, then the burr enlarges the opening so small rongeurs can be used to remove the bone.—Sharpe. (See p. 241.)

PLATE X.

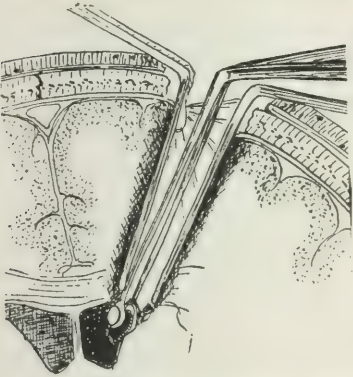


Complete ankylosis of jaw due to fixation of temporal muscle following Gasserian ganglion operation.



Appearance after removal of coronoid process and attachment of temporal muscle.—New. (See p. 255.)

posed mostly of wounds which gave no neurologic evidence of intracranial involvement and in which the operative investigation revealed nothing to indicate subdural involvement. Most of the remaining cases were of extensive brain lesions, with lacerations of venous sinuses, combined lesions with frontal sinus, orbital or mastoid complications. Several were of brain abscess in which there had not been complete early operation. In this series there were 13 fractures with intact dura, 9 of which were complicated with either extra- or intradural hemorrhage producing compression symptoms of varying degree. Five deaths comprised the total mortality in this series as far as it has been possible to determine. One patient died from pneumonia 2 weeks after operation; one could not be traced but was recorded as having died. One such patient recorded as probably dead was found in the U. S. in good health. These results represent only the primary operative mortality. Judging from the reports on hand and from the many cases observed, Ney believes the late complications following the complete operations at the front will not be numerous. In about 200 such patients not a single brain abscess or cerebral hernia was found in any having had this complete early operation.



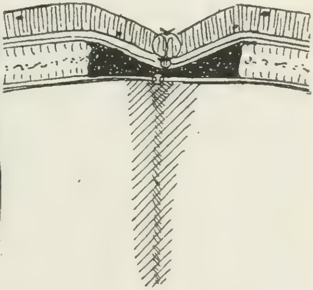


Fig. 86. Removal of foreign body from ventricle. Direct inspection possible by use of retractors.

Fig. 87. Closure of dura and scalp without drainage after complete operation (Ney).

Primary suture of craniocerebral wounds was carried out in 18 instances by E. Chauvin.[5] The method follows: The wounds without any opening into dura were closed completely without drainage. In the encephalic foci which can be clearly asepticized, a nonpenetrating drain was left in 3 days. In deep foci the tube was left in 3 to 5 days. Wounds with opening of the venous sinuses and bleeding were tamponed. The end-results were: Out of 18 cases, 13 healed *per primam* and were discharged; 1 was sent out with drain; another discharged late though well on way to healing, 1 died, and the other 2 could not be traced.

A series of *16 foreign bodies in brain* were removed by M. Rocher,[6] 7 with the electromagnet. (*A*) Immediate, 2 with forceps controlled by *x*-rays; both successful. (*B*) Early, 4 with magnet all successful; 1 with forceps controlled by rays, death. (*C*) Late, 3 with magnet, all successful; 5 with forceps, curet or director, 3 deaths; 1 object not extracted. The older the wound the more difficulty.

P. de la Villéon in the discussion said he believed the use of forceps simple and easy. He thought it dangerous to draw the bullet through without knowing whether it was presenting end-on or crosswise, the latter causing much damage.

Rocher replied that the bullet always was directed parallel to the magnetic lines, hence could only present by point or base, leaving but a small wound; the use of forceps was often very difficult, blind and much more destructive. He advocates systematic extraction of projectiles, and cited 3 instances where small staphylococcal abscesses were found about the missile. These had caused no symptoms, but it was only a question of time for serious effects to follow.

Epilepsy. As a *prophylaxis against Jacksonian epilepsy*, R. Earl[7] wishes to emphasize that all head injuries whether received at birth or subsequently, should receive prompt and adequate surgical treatment. Be-

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(5) Progrès Méd., Sept. 21, 1919.
(6) Presse Méd., Oct. 11, 1919.
(7) Minnesota Med., September, 1919.

cause all lesions lying over the motor area do not cause epilepsy we must conclude there is a susceptibility in some patients and not in others. Before undertaking operation the so-called medical, treatment should be given a thorough trial. Although operative results have not been brilliant, the outlook without surgery is practically hopeless. When a definite lesion is removed a complete cure may be looked for. When no lesion is found the epileptogenic area should be located by electrification and removed. If surgery does not effect a complete cure the attacks are usually lessened. Operation should be undertaken as soon as the diagnosis is made or time may establish the "epileptic habit."

Concerning *the surgical treatment of traumatic epilepsy*, A. C. Strachauer[8] remarks that removal of the cause without prevention of the recurrence of such cause is usually wasted effort. Exuberant marginal callus widely removed, leaving a clean-cut smooth border, does not recur. Cysts from which half and preferably the entire sac, is removed are permanently destroyed. A cortical cicatrix removed smooth, dry, and aseptic, heals with slight scar formation. The scars from aseptic operations do not cause epilepsy. The problem now becomes the prevention of adhesions of the brain to the meninges, scalp or skull, and the supplying of the defect in the removed dura. Cargile membrane, celluloid, gold foil, and rubber tissue have been employed with varying success. Perthes used fresh hernial sac in 7 cases with success in 6, and a death due to infection. Strachauer employed autoplastic transplants of fascia lata with a thin layer of fat in 9 epilepsy cases, and 2 as prophylactic measures. The graft is obtained from thigh at time of brain operation and placed fat side down. It is handled entirely with instruments, and is sutured snug and taut into the defect. In all cases it healed without reaction. One case was not at all improved, convulsions recurred in the hospital; this patient was not made any worse. The other cases have all been greatly improved. One case has remained entirely cured for over 4 years. Some of the improved cases have

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(8) Ibid., October, 1919.

been able to resume their occupations; one case previously incapacitated is able to perform manual labor due to the great improvement in a spastic paralysis.

Every skull injury should be viewed as to its epileptic potentiality. It is evident that traumatic epilepsy is frequently preventable by appropriate treatment of the primary injury. The surgeon's responsibility in a skull trauma does not cease until complete preventive efforts have been instituted, even though several operations are required. When the attacks are established many of the cases can be improved and some cured. The mental deterioration is so rapid that even improvement is an unmeasurable blessing.

[It is important to supervise the diet and mode of life of patients operated on for relief of epilepsy, because it has been observed the recurrence is often preceded by some indiscretion in diet, some dereliction, or in several cases—undue exposure to heat.

The elimination—to a considerable extent—of the use of table salt, by directing the cook to use little salt in the preparation of food, and instructing the patient not to add any salt at the table, seems to be of value. In place of table-salt the patient should add sodium bromid to his food at the table. In order to regulate the amount, he should place half a teaspoonful in a salt-shaker every day, and use this amount during the three meals. This makes the food more palatable, and provides an amount that can be taken indefinitely without any apparent harm.—Ed.]

Tumors. H. L. Whale[1] reports the case of a **woman,** of 29, in whom *sellar decompression and removal of endotheliomatous tissue* from the anterior lobe of pituitary, was followed by great improvement in the pressure symptoms. When she first sought advice (Sept., 1917), sight had been failing for 6 months. The following August, headaches began, worse in a. m.

First seen by Whale, March 4, 1919. Headache was now acute and nearly constant in vertex or occiput. Occasionally a moderate degree of proptosis (left), which at other times was absent; divergent squint (left). Diplopia had existed 2 years ago, but only lasted 3

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(1) Lancet, July 5, 1919.

months, when sight (left) began to fail. Lethargy was obvious. Her sugar tolerance tested, took up to 5 oz. in eight hours without any appearing in urine. Nose and sinuses normal. Skiagram showed a large pituitary fossa. Operation, March 8. The chart shows the improvement in the nasal field of vision.

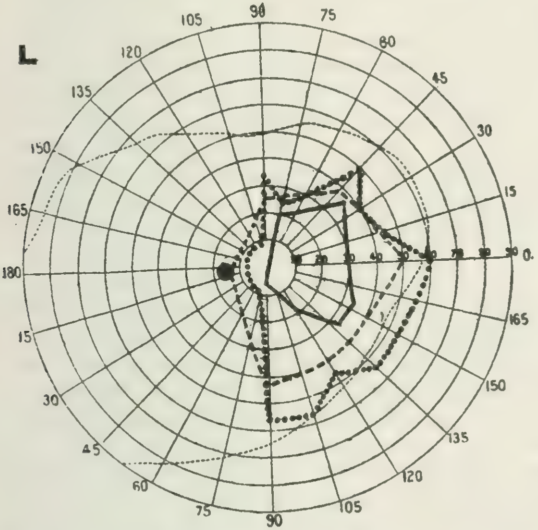

Fig. 88. Improvement in nasal field of vision, black line, Sept. 18, 1917; interrupted, March 22, 1919; dotted, March 29. Immediately previous to operation only perception of light on left (Whale).

THE FACE AND MOUTH.

The different methods of *general anesthesia applicable in cervicofacial surgery* are considered by L. Dufourmentel.[2] He concludes intrarectal anesthesia—by its innocuity, and absence of all disagreeable features—is indicated in the child, and in adults who are feeble or suffering with pulmonary lesions. Ordinary inhalation suffices for operations not involving the buccofacial sur-

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(2) Presse Méd., Feb. 13, 1919.

face directly and not calling for rigorous asepsis. Inhalation by laryngotomy is the most sure and simple plan for cases where we operate inside the buccal cavity or in its immediate vicinity or where asepsis must be strict (bone grafts). It enables the most severe operations, *e. g.*, pharyngectomy, to be done without interruption, hence with least time. It is the only one available where the mouth is artificially or pathologically closed, while its inconveniences are negligible. After a thorough trial of other methods, he has become a firm advocate of it. In other instances, the remaining plans (pharyngeal-laryngeal- and tracheal-intubations) suffice. These are merely improvements of ordinary inhalation, while laryngotomy is a complete change.

A note on *solid paraffin in facial surgery* is furnished by S. Mort.[3] Melted paraffin has many disadvantages. The syringe usually gives great trouble, and the wax is put in scalding or else it solidifies in the needle. Press hard on the plunger and a quantity may suddenly be thrown under the skin, solidifying at the wrong place, and not to be extracted without scarring. Further, melted wax will adapt itself to the skin probably in the wrong place, instead of which we should have skin tissue moulded and adapted to the shape of the wax. Cases, too, have been known of sudden blindness following melted wax injections. For these reasons, principally, Mort is using solid, cold wax, cut to shape, and introduced through a small prick.

The following is the technic in saddle-nose: (1) Sterilise the wax efficiently by melting in a pot. (2) Make a ¼ in. prick near the depressed part with a tenotome. (3) Elevate around the incision to the required extent with a small elevator. (4) Have wax poured out to about ½ in. deep in dish and solidified in a basin of cold sterile water. (5) Remove *en bloc* from the small dish with an elevator. (6) Break to size (it will not cut properly) and afterwards trim to shape with a knife. The little shaped-splints are about ¼ by ¼ by ½ inch. Several may be deposited in the one subcutaneous tunnel. (7) Push wax into place through incision, stitch wound with fine catgut, and apply a collodion gauze dressing.

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(3) Lancet, July 19, 1919.

It will be found best to do these operations in stages. More can be done later. Small pieces will lie undisturbed and unabsorbed; larger bits might work out through the wound. Avoid smearing the little incision with wax, as this delays primary union of the edges. Rather drop the piece right into the undermined skin, then push it home. At the conclusion a vigorous massage of nose while still under the anesthetic will give an artistic finish to the part. The operation is splendidly simple in actual detail.

Melted wax is of no service for hide-bound scars to be elevated. These must be raised by undermining with a raspatory through a small incision and kept in position by a solid bar of wax. A depressed skin deformity on any part may be similarly treated.

Malar. For diagnosis of *depressed fractures of the malar,* A. E. Rockey[4] has devised a method which definitely determines even a slight depression. Two straight wooden applicators are placed, vertically at the outer edge of the orbit from the prominence of the cheek bone up. If depression exists, the difference in angle is obvious. The swelling may be pushed out with the finger tip and the end of the applicator given firm rest on the bone. The facility and accuracy of this method may obviate the flat cheeks which are permanent deformities unless timely correction is made.

Jaws. In the 1919 volume (p. 284) reference is made to Henderson and New's article on ankylosis of the jaw. In a subsequent paper[5] G. B. New discusses the type *due to fixation of the temporal muscle:*

A man, of 36, had had a Gasserectomy done at the Mayo Clinic 42 months previous. While relief from pain was complete and permanent, the ankylosis was also complete. The incision was the same as that for arthroplasty of the temporomaxillary joint. The skin and superficial tissues were incised down to temporal fascia. A mastoid retractor was inserted and the zygoma exposed well forward. In elevating the soft tissues over the zygoma it is essential to keep close to bone, preventing injury to facial nerve. By blunt dissecting

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(4) Jour. Amer. Med. Ass'n, Jan. 4, 1919.
(5) Ibid., July 26, 1919.

scissors and a periosteal elevator the inner surface of zygoma was freed so a piece 1 in. long was removed with a Gigli saw. This was placed in a warm, wet sponge. The temporal muscle and coronoid were then exposed and removed with a curved chisel and a bone-biting forceps. The attachment of the muscle to the asc. ramus was removed by blunt, dissecting scissors. The temporomaxillary joint was exposed but not opened, and found to be normal. The piece that had been removed was replaced and sutured by catgut, and the wound closed. The following day patient could open his mouth, and in a week was able to separate teeth 1 in. The

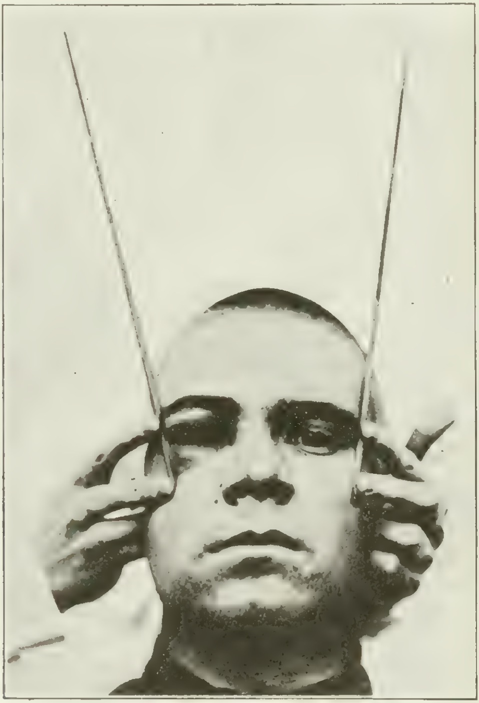

Fig. 89. Method of diagnosis in depressed fracture of malar bone (Rockey).

facial nerve was not injured. He was given a mouth-gag, but preferred to use wooden tongue depressors placed together on the flat to exercise jaws. This good function has been maintained for 4 months at time of report. (Plate X.)

After considerable experience Billington, Parrott and Round[6] describe their *technic for bone grafting in compound fractures of jaw:*

The curved incision in the neck begins 1 in. behind the end of post. fragment and ends 1 in. in front of end of ant. fragment. It is only by carrying incision well below jaw and raising sufficient flap that enough soft tissue can be had to envelop the graft satisfactorily. Often at fracture there is nothing but dense scar tissue extending through to mouth, and great care must be taken in splitting this to avoid opening into mouth, which necessitates postponement. The unsatisfactory bed of scar tissue is one of the difficulties. Deepen the incision by cutting up and in until the lower borders of fragments are reached. The soft tissues covering the outer surface of each are raised for 1 in. away from gap and turned up in flap. The ends of fragments and the fibrous tissue in gap between are now carefully cut away. Finally, each fragment is bevelled by cutting a flake off outer surface with bone forceps. In this way raw bone is exposed at the ends of gap and on outer aspect of the fragments for about 1 in. All bleeding is then arrested and the graft prepared.

After using the ribs, tibia, and jaw itself, the iliac crest was finally selected. It is tough and can be cut with forceps without splitting. Further, a graft can easily be obtained of any length or breadth and the slightly curved contour is approximately that of the jaw. Preferably from same side as operation wound, allowing one to lie comfortably on the opposite side. An incision is made over crest from a.s. spine as far back as required. The muscles are then separated on either side of crest and tracted back. The bone is cut by an ordinary hand saw. The graft should be 2 in. longer than the gap. If a more curved piece is required, as to fill a gap near chin, the graft is made to include the

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(6) British Med. Jour., Dec. 21, 1918.

bone between the sup. and inf. spines. In this way a graft 4 in. long has been obtained which filled a gap from angle of mandible on one side to well beyond chin on the other, and the curve was so accurate no subsequent modeling was needed. After removal of bone the muscles detached are sewn together with catgut and wounds closed. No inconvenience whatever seems to result. The ends of graft are now bevelled with forceps, the bevelled areas lying on the prepared outer surfaces of jaw fragments. In this way the graft overlaps the gap at each end for 1 in. Two advantages result from this: (1) A broad line of bony contact is provided with increased prospect of speedy firm union, and (2) a certain sliding can take place without contact being lost.

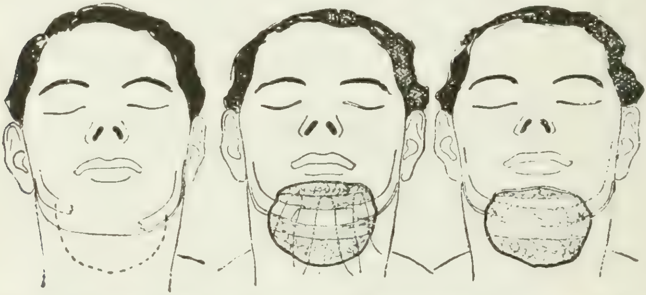

Fig. 90. Incision for bone grafting in compound fractures of jaw.
Fig. 91. Same, graft in place.
Fig. 92. Same, closure of wound (Billington-Parrott-Round).

No attempt is made to fix graft or fragments by plates and screws, by wiring, or even by dovetailing the graft into the fragments. All these measures have been tried and discarded. Their practice is to keep graft in place by sewing soft tissues closely over graft and ends of fragment by hardened gut. This closely surrounds the graft with living vascular tissue and abolishing dead spaces. This improves the nutrition of the graft and diminishes the risk of sepsis. Finally, the skin is approximated with a few interrupted stitches. No drainage beyond leaving spaces between the skin sutures to allow escape of serum. A simple dressing and bandage is applied and the patient sent back to bed. No attempt is made to reintroduce dental fixation splints until the wound is firmly healed and the compound fracture has been converted into a simple one. This usually occurs in 2 weeks, after which the case is treated as simple fracture of jaw. Firm osseous union occurs in 2 to 4 months, but it is inadvisable to fit the final dentures until at least 4 months have elapsed, and it is perhaps wiser to allow 6 months.

W. S. Schley[7] discusses *surgical treatment of cancer of the maxilla.* The percentage of cures is not large, due to several factors—the great malignancy of these growths, especially the squamous-celled carcinoma; the late stage at which so many present themselves, not infrequently owing to wrong early diagnosis; and *very largely* to an incomplete primary operation. Removal of the maxilla is still too infrequently done. Its apparently formidable character, with seemingly inevitable disfigurement, causes both surgeon and patient to hesitate. A number of cases are turned down as inoperable which are not especially difficult, and which when operated upon later have given cures over 5 and 3½ years and are still apparently well; another (well nearly 7 years after the last of two fairly prompt local recurrences) has been heard from recently.

Cancer of the upper jaw, and especially in the antrum, fortunately remains *local* until comparatively late; nor does it tend to metastasize to the degree of cancer elsewhere. The great majority of recurrences are *local.* Glands in the neck in addition to the primary focus are not always a contraindication, and Schley has seen such cases after a thorough neck dissection from below up, keeping wide of the involvement, remain free of any further neck invasion for 3 years, and not develop at all subsequently even when local recurrence towards the orbit or pterygoid region occurred. It created a distinct lymph block—to be considered in all operations for malignant disease, and especially in mouth and jaws. The primary operation must be thorough and well beyond the appreciable limits, as recurrences are often infinitely

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(7) Annals of Surg., January, 1919.

more difficult, and at times impossible, to deal with; and by delay valuable time is lost. It is amazing how much can be done (and with so little reaction, as blood loss is small) with external carotid ligation or compression. In upper jaw involvement we do not interfere with the muscles of deglutition as in removal of the lower jaw, and have not that added source of danger. In the upper jaw as in the lower, carcinoma is more frequent than sarcoma. Giant-celled sarcoma here as elsewhere gives a better prognosis. If the growth is confined to the maxilla alone, or with the nares, the problem is greatly simplified. With surface or deep extension towards the soft palate and faucial pillar, or involvement of the orbit or skin of the face, the difficulties are considerably increased. Where the disease has invaded the pterygoid muscles and sphenomaxillary space it is hopeless. The operability is not always easy to determine. It is not invariably its extent that must determine this point. Its variety, malignancy (so far as determinable), chief situation and apparent and probable direction of extension, and condition of patient must all be weighed.

Preparation for operation is important. Where necessary or advisable Hb. should be increased and the general condition improved as much as possible during the time it is considered wise to wait. Mouth cleansing, especially with tumors involving the alveolar border, hard palate or buccal mucosa, must be thorough. Good skin cleansing and disinfection of the face insures rapid and accurate primary union of the flap. A small dose of morphin and atropin at beginning of anesthesia, which is continued through nasal tubes, diminishes the anesthetic needed and tracheal secretions, while contributing to anesthesia and seeming to reduce the afferent impulse to brain. The Fergusson incision—through midline of lip, about ala of nose, towards inner canthus and thence out below orbital margin—gives excellent exposure and command. This incision is a good one for benign growths far back on jaw, and with the bony support of the cheek unimpaired; the scar, with careful suturing, is scarcely distinguishable and the functions of muscles unimpaired. The flap is easily replaced and if edges are kept clean very rapid union takes place. Cutting through bony attachments, the orbital plate should be left if possible to support the eye. The incision through the hard palate and the division from the soft should not be forgotten before avulsion of the bone. It is essential to avoid contamination of skin edges with tumor tissue and to work always outside the growth and not through it in removal. The cavity is packed snugly with—preferably—iodoform gauze in one strip and the end brought out of corner of mouth and secured after suturing flap. This remains 6 to 7 days, gauze wrung out of one of the milder antiseptics replaces it at short intervals thereafter. Healing is more rapid than expected, though with extensive areas several months may elapse. With good preparations and technic the mortality is not large. In recent years 12 to 13%; 20 to 30 in Europe because of more extensive operations. The earlier fatalities were largely from sepsis and hemorrhage; also pneumonia (in one series 72%).

In carcinoma the neck should be dissected whether nodes are palpable or not. In sarcoma, unless nodes are palpable, dissection is rarely necessary, though commendable. The dissection may be done prior to removal or at same time; in either case it should precede removal of jaw. The skin of cheek, even with bulging from growth within, seems rarely involved and can be used in replacement. Cases that have been tampered with by local cauterization, electricity and incomplete excision have proved most malign. Within the antrum, suppurative conditions may mask a coexistent or causal malignancy. A number start in a polyp, and not infrequently a portion removed for diagnosis does not go deep enough to show the major condition. In a case sent recently with a diagnosis of extensive polyp formation of the nares (the pathologist having reported pure polyp) Schley's own specimen taken at a deeper portion showed squamous-celled carcinoma. At operation the entire antrum was filled with neoplasm and the disease extended up to the ethmoid cells. Finally, the operation of to-day is not productive of considerable shock, bloodletting or delayed convalescence. Present more comprehensive primary operation offers renewed hope in this field of surgery.

Tongue. One of the topics for discussion at the 1919 French Surgical Congress was *operative treatment of lingual cancer.* P. Sebileau[8] the first referee said it was always a matter of hesitancy to pronounce such cancers "cured." Though exceptional instances have been met with of 10- 15- and 20-year survivals, it is estimated that for cases operated on early, the 3-year limit is reached in about 40%. The survivals for growths of long standing, and for operations by the parietal or mandibular routes are much rarer. They are to be met with, however, and no matter how few, they make it a duty for surgeons to persevere in this imperative surgery, though the way is full of deceptions, and Sebileau refuses to consider it as "splendid surgery and full of hopes." In conclusion he quoted approvingly the words of Trélat long ago (1882):

> "It is not major operations which are called for in cancer of the tongue; it is on the contrary, the minor operations, for such operations are done in the beginning."

M. Vallas the co-referee, gave the statistics of his own cases: (*A*) Involving free portion, from 1907-13, 32 cases with 3 operative deaths, and 14 (44%) over 3-year limit; (*B*) Cancer of base. These are rarely seen, they soon invade the pharynx, palate or tonsil. Vallas did 5 operations by the transhyoid route, with an operative death, and all were less than 3 years old. (*C*) Extension to floor of mouth, 37 cases with 45% mortality. Three survivals over 3 years, and one of 12 years.

He believes the operative treatment is the only one which gives definitive cures. Thus far it is not possible to tell whether radiumtherapy should be classed as palliative or curative. Hence there is room for perfecting as much as possible the technics and methods.

Parotid. P. P. Cole[9] considers *fistula of the parotid.* This is a rare complication of facial wounds. Even during the War, in four years he saw but 16. There are 2 kinds: Fistulæ of the duct (subdivided into in-

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(8) Presse Méd., Oct. 15, 1919.
(9) Lancet, June 7, 1919.

complete and complete) and fistulæ of the gland. The differentiation of incomplete duct fistulæ from those of the gland is difficult and the diagnosis is sometimes a mere probability based on the position. Operative verification has not been available, for both have a tendency to heal. If this is delayed radium or *x*-rays are indicated. Gland- and incomplete fistulæ have never failed to respond to radiations.

Complete fistula of the duct is curable only by operation: 1. Seton; 2. Atrophy; 3. Reparative operations. Setons usually fail and render more difficult any subsequent reparative procedure. No. 2 aims at cutting off secretory fibres in the auriculo-temporal nerve, by resection or avulsion, advocated by some American and French surgeons on the grounds that the operation is easy, absence of secretion causes no discomfort, and reparative operations leave an ugly scar. Unless other things are equal, the plea of facility can lay no claim to serious consideration, for at present these cases should only be entrusted to surgeons who can confidently carry out any procedure that will give the best result. Other things in this instance are not equal, for in the 2 cases that Cole encountered dryness of the mouth was a cause for complaint, and in both an opportunity was afforded at the operation of excising scar tissue which had formed as a result of the original injury. In both cases several previous attempts had been made to re-establish communication by seton methods, the only result being to add new difficulties to those already existing.

The general principle of operation adopted was that if the duct will not reach the mouth cavity the mouth cavity must be made to reach the duct. A curved incision was made with convexity down and a small flap reflected up (1). This displayed the duct, the distal end of which was ill-defined and buried in scar tissue. A small lateral hole in the duct marked the limit of patency. The duct was then freed, its terminal portion resected, and 2 very fine catgut traction sutures passed through its walls. The mucosa covered by buccinator was then made prominent immediately in front of masseter by a small swab pressed against it from inside the mouth, and a small longitudinal incision made through it into mouth (2). The masseter was nicked at its ant. border and the margins of mucosa stitched to the deeper margins of the wound (3). Through the aperture thus created the stay sutures were passed and the duct gently pulled into the funnel-shaped extension of the oral cavity. The duct was buried in the extension and the extension cut off from communication with the exterior by catgut sutures passed as illustrated in 4 and 5. The skin wound was then sewn up, drainage being established through a small stab. Each stay suture

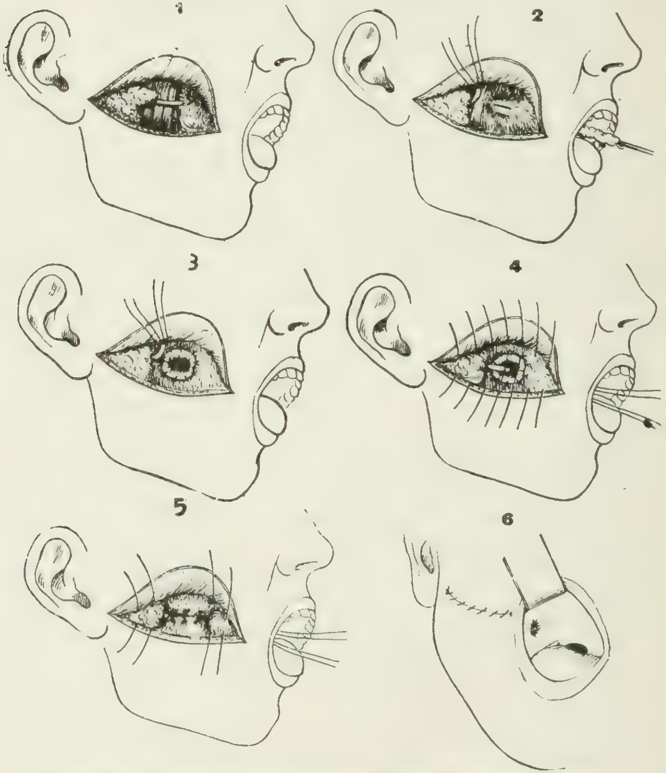

Fig. 93. Technic for closure of parotid fistula (Cole).

through the duct was then made to take a good hold of mucosa inside the mouth, so when tied the duct was secured in place (6). In both cases slight suppuration with a discharge of saliva occurred about 10th day. Communication with the mouth had, however, been well and visibly established and firm healing occurred in a few days. Both cases were kept under observation for 3 weeks and then discharged as cured. No facial paralysis occurred.

[See also 1915 volume, p. 237.—Ed.]

THE NECK.

A man, of 64, consulted W. W. Pearson[1] on Tuesday, giving a history as follows: The previous Friday evening at dinner while eating meat, he was seized with a choking spell. His impression was a piece of bone lodged in his throat when he attempted to swallow. From Friday until Tuesday, he had practically nothing to eat nor drink. His complaint was inability to swallow on account of pain, and the closed passage-way.

He was tall, thin, a type which admits of easy examination. When on the table and the suspension apparatus employed, the esophagoscope was introduced without difficulty into stomach. A direct view of the respiratory tract to the bifurcation of trachea was had, simply because of the position secured by means of the suspension. For a moment the complaint and the findings were confusing. A glance however at the region of the hyoid bone showed a lack of symmetry which at once attracted attention. The *x*-ray taken showed a *fracture of the left greater wing of the hyoid.* The voice was weak when first examined. With the application of adhesive straps, and the assurance there was no foreign body, the patient returned home.

A probable *rupture of the thoracic duct* came under the notice of R. H. Marten:[2] About 5 weeks previous, a man, of 21, fell off a motorcycle, landing heavily on l. shoulder. Next a. m. he noticed a large swelling in

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(1) Jour. Iowa State Med. Soc., November, 1918.
(2) Med. Jour. Australia, May 24, 1919.

the posterior triangle, somewhat tender, but soft and not blood-stained.

When seen the swelling was about the size of a tangerine and appeared just above l. clavicle, coming out from under post. edge of s. mastoid, partly overlapping this muscle medially, and extending laterally to the ant. edge of the trapezius. It was absolutely painless, soft, almost doughy, irreducible, non-crepitant, with no impulse on coughing, and reminded one of a cystic hygroma. It was quite translucent to *x*-rays or transmitted light. No enlarged veins over the surface and apparently it caused no pressure signs. It was dull on percussion. If it had not been for the sudden appearance patient would have been unaware it was there. Positive that neither he nor any of his relatives had ever noticed any abnormality before his accident. It had been proposed that a hypodermic should be inserted; but, as the prick might have been followed by a troublesome fistula, it was decided to leave it alone. All the time the swelling was under observation it remained exactly the same. The diagnosis was beset with difficulty. It was not hemorrhagic, as it never had any discoloration about it, and it never became hard like a hematoma and, if it had been, it would not have been translucent. It was not a pneumatocele, as they have a peculiar crepitant feel, are resonant, have an impulse on coughing and vary in size with inspiration and expiration. The only diagnosis left was an injury to the thoracic duct, probably not the main duct but one of the numerous branches it frequently splits up into before it enters the subclaviojugular junction.

Gunshot Injuries of the Cervical Nerve Roots are discussed by J. S. B. Stopford[3] based on 3 cases with- and 3 without cord lesions.

The segmental distribution of both sensory and motor symptoms is most helpful in diagnosing a radicular from a spinal injury. The absence of any alteration of reflexes or sensory disturbance below the injury is further evidence against any spinal injury, but in so many root lesions there is some disturbance of conduction in the cord also. A localised hemorrhage into the

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(3) Lancet, March 1, 1919.

grey matter might cause a lower motor lesion of more or less segmental distribution, but, instead of being accompanied by loss of sensation in the corresponding sensory segment of the same limb, would most probably be associated with altered reflexes on the leg of the same side. According to the size and position of the hemorrhage there might also be sensory disturbances in the lower limbs, but these would show a different arrangement and dissociation from those due to lesions of peripheral nerves.

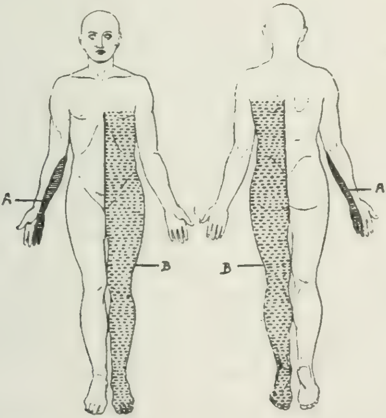

Fig. 94. Objective sensory disturbance in Case 5. *A*, of peripheral origin; *B*, of central origin (Stopford).

The differential diagnosis from brachial plexus lesions is often difficult. Signs of concomitant loss of conduction in the cord, even if only due to concussion, would be in favor of a root injury. The segmental distribution of symptoms is helpful in distinguishing from an injury of the lower part of the plexus, but of less service in differentiating from an injury of the trunks, which would also give segmental symptoms. In the latter difficulty, help may be obtained often from the greater and more frequent dissociation between sensory and motor symptoms in radicular lesions. In some the decision is exceedingly difficult, and in one patient the plexus was exposed in error right up to the intervertebral foramina with, of course, negative results. The clinical condition at the time of operation warranted the diagnosis of an incomplete division of the upper trunk of the plexus, but an inquiry into the history would have suggested the probability of the correct localisation.

When suspicious of a root injury the presence of slight increase of the reflexes of the lower limb on the same side is of great diagnostic value.

Radicular injury. The affected limb or limbs must be supported at the earliest possible moment, so all paralysed or paretic muscles are relaxed. This is particularly important in lesions of 5 and 6 C. roots, since failure to support the deltoid and spinati in the early stages causes irreparable damage to the muscles, which will delay and limit recovery and render contracture of antagonistic muscles probable. At the outset, when the whole limb requires support, no appliance can compare with an abduction splint fitted with suitable forearm attachment, which can be modified slightly to meet the special requirements of the patient, to support the muscles acting on the wrist, fingers, and thumb.

Of almost equal importance is daily passive movement of all joints to prevent mechanical limitation of mobility from contractures and arthritic adhesions. Persistent immobilisation at this time frequently gives rise to disabilities which last longer than those due to the nerve lesion directly, and in themselves may cause permanent incapacitation. Beyond this little is required except daily massage of the whole limb to maintain general nutrition of the muscles as far as possible. With the earliest return of voluntary movement careful muscle training may be commenced, but care must be taken at first not to fatigue the recovering muscles. If the muscles have been well supported from an early date and daily mobilisation practised wonderfully good results can be induced by skilful and persistent muscle training. The support of the muscles must not be dispensed with too early, not until a fair range of voluntary movement has returned, and even then it is preferable the splint should be worn at night for a time.

In the later stages employment, suitable for further development of the muscles, may be undertaken.

Spinal lesion.—In the type to which this paper refers the spinal lesion rarely causes any very serious trouble. The little spasticity which may be experienced can generally be relieved by massage and only infrequently persists. If it provided serious disability at a late stage and showed no signs of improvement, rhizotomy might have to be considered. The weakness in the legs usually improves with graduated exercises, and most patients have been able to walk 2 to 3 miles without discomfort.

The treatment of the *scar* has also to be considered, since it may restrict seriously the mobility of the neck. Ionisation and manipulation will generally loosen it sufficiently to prevent any serious limitation, but in some the extent may necessitate its excision.

Cervical Adenitis. In *tuberculous adenitis,* L. Dufourmentel[4] believes there is no need for drainage. The reason why exeresis has been so vigorously opposed by most authorities on tuberculosis is due in great part to the frequent fistulization which necessitates prolonged care and leaves marked scars behind. This fistula formation, he asserts, results from the systematic drainage. He had occasion recently to make extirpations in 63 instances of these tuberculous nodes. In over half he found softened foci which burst during the manipulations and the pus inundated the wound, yet none of the wounds were drained, he considers such pus as sterile. (This belief was confirmed by many laboratory investigations.) In all cases the wound was united primarily and never gave way. On 6th day skin clips were removed and about 15th day, patient discharged.

Of course, this method is not suited for every case. *E. g.,* in women, even a linear scar is important, and they prefer, as a rule, some non-operative plan, even though it takes much longer. Excellent means are at our command for disposing of these adenopathies, even though suppurating and voluminous. But surgical extirpation, on account of the rapid result, seems to the author indicated (A) In males who do not mind a scarcely visible scar, provided the treatment is short in time.

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(4) Presse Méd., Dec. 5, 1918.

(*B*) In all cases where traces are still existing or such as result from repeated punctures which are as visible as an incision—especially as with careful suturing, the traces of the knife can be nearly hidden. If we wish to prevent recurrence in large measure, the pharyngeal or dental lesions which are so often the atrium must be carefully looked after.

M. B. Hutchins[5] treats of *tuberculosis of the submaxillary and cervical nodes in the elderly.* He finds it rare, and in the 3 cases the focus of infection or point of entry unrevealed. I, a woman of 68; possible primary lesion, an ulcer of left cheek, and tuberculous metastasis to lymph node of submaxillary gland. Six years later another enlarged submaxillary node discovered and not disturbed. This woman was enveloped in tuberculous connections. II, woman of 76, refractory, old, typic epithelioma of temple. Sudden and rapid development of apparent "skip" metastasis to cervical glands, diffusion becoming quite complete, even to lower parotid and pretrapezius regions. Diagnosis of carcinoma substituted by tuberculosis on exposure of true condition during operation. III, man of 63, very stupid mentally and exceedingly deaf. Tuberculous history hazy, dubious. Primary involvement of r. lobe of thyroid, complete destruction and replacement by an enormous abscess. Secondary involvement of 2 nodes in clavicular region, their partial destruction by tuberculosis and pus and early stage of disease in small nodes beneath omohyoid. Seepage of blood, purposely provided in Case III, restraining virulent reinfection, though a moderate abscess developed below operative area. Rapid completion of closure and healing of cavities by dressing of cotton in compress form roofed in, air-tight, with ahesive strips, no pus appearing after the first application of this dressing. The use of iodoform gauze strips for drainage, on old theoretical grounds. Clinical recovery of patients I and III, post- (or propter) operative death of II.

He concludes tuberculosis of submaxillary and cervical lymph-nodes should be considered in cases of the elderly, and primary development of this disease in the thyroid

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(5) Annals of Surg., November, 1919.

is definitely established. Carcinoma seems the most likely erroneous diagnosis, but the softer consistence and erratic, non-serial involvement of nodes should aid in exclusion. Aspiration of cases reported would have revealed pus in at least 2. The microscope might have completed diagnosis from this aspiration. Less continuous and "clean" dissection and proper after-treatment effective as to cure of disease—whereas a carcinomatous process of equal extent would have almost certainly recurred. Surgical treatment indicated and successful, recurrence of tuberculous condition less probable and more easily controllable than in childhood and youth.

External Carotid. Attention is called by W. P. Nicolson[6] to some *points in ligation of the external carotid.* In any operation about the face or neck, in which hemorrhage may become a serious factor, it simplifies the work wonderfully. It does not prevent bleeding, but makes it controllable without ligature by simply clamping bleeding points for a few minutes. Perhaps its principal usefulness is preliminary to removal of the upper and lower jaws. It should always be done under the same anesthesia, and not a few days before, as has been recommended by some. In jaw cases, though hemorrhage is often very free for a short time, no ligature is required, even for the temporal or int. maxillary. In removal of the Gasserian ganglion, it has been pronounced by many as unnecessary and not helpful, and to this Nicolson disagrees. There are 2 factors in this operation fraught with serious hemorrhage: the scalp and the middle meningeal. Writers speak of the ease with which a torn meningeal can be controlled by ligation or pressure, but tying the carotid has been easier than tying the meningeal. One author advises if the middle meningeal is accidentally injured and cannot be tied, the skull should be packed and the operation resumed 2 days later. In a case in which this occurred, after trying in vain to control the artery, Nicolson tied the carotid in 5 min., the hemorrhage ceased, and the operation was completed without further difficulty. In removal of fibrous tumors in the back of the throat by laryngologists, in which hemorrhage is

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(6) Surg., Gynecol. and Obstet., July, 1919.

serious, the ligation has been done for them, and the tumors removed without difficulty and little hemorrhage. In removal of the tongue and floor of the mouth, it is exceedingly useful, making the balance of the operation simply one of trimming away the growth. In removal of the lower lip for cancer, the operation is found exceedingly useful, and in no way interferes with primary union.

A skin incision 1 to 1.5 in. long, with its centre opposite the upper border of the thyroid cartilage is usually ample. The incision should go through skin and platysma. After the deep fascia has been opened, with the index finger, the way can be rapidly torn down to the vessel, without damaging any structures. We are often told that the guide is feeling the pulsation with the finger, but the rapid breathing makes this very unreliable. It is useful to remember that the common carotid always has a bulbous swelling just as it bifurcates. The vessel is recognized by its yellowish white color. Should the trunk of the lingual and facial vein cover the artery extensively, it can be pulled out of the way with a hook or cut between forceps, and it should be tied at once. The point of election is the immediate crotch of the vessel, for thus no space is left in which thrombus can form. At this point, the space between the vessels is simply an indistinct groove. The aneurism needle is passed from within out, and when it comes against the dense connective tissue, it appears as if coming directly through the walls of the artery. Rub the point through with the finger or some instrument, and thread it, and withdraw the ligature with it. This seems to work more satisfactorily than when threaded beforehand. A practical point of extreme value is to have the anesthetist place his finger upon the temporal, and the operator either cross or pull upon the ligature, to see it stops the circulation. The ligation should not be done with a grunt and a jerk, because Ballance and Edmunds, many years ago, demonstrated that a pressure of 3 lbs. was sufficient to close the common carotid. Just enough force should be used to stop the circulation, and bring the inner walls of the vessel together. Nicolson employs a double strand

Ballance knot with No. 00 or No. 0 forty-day chromic gut; larger sizes are entirely unnecessary, and sometimes harmful. All clamped vessels are now tied with fine catgut, and the skin closed with No. 00 chromic gut without drainage. In many cases, the entire operation can be completed in a few min., and the ultimate shortening of the entire operation is so great that these few min. are well spent. Dawbarn demonstrated there were 17 different routes by which the anastomotic circulation takes place, so in a few days, pulsation returns in the temporal.

A case of *traumatic aneurism of the external carotid* successfully operated on is detailed by S. C. Dyke.[7] A soldier, aged 34, was wounded Aug. 8, the bullet entering l. side of nose and passing out through r. external meatus. Aug. 13 admitted (England). He then had little pain, wounds both clean; there was considerable swelling over r. parotid region, and apparently limited by the fascia. This showed no signs of inflammation, and was ascribed to extravasated blood. *X*-rays showed some fragments of bullet casing and a fracture of asc. ramus. Aug. 22 patient complained of much pain and it was found the swelling was now pulsatile. On 23d, carotid was exposed through usual incision. The operation was difficult by the shortness of neck, the bifurcation being right up under the angle of jaw. The pulsation of swelling was completely stopped by occlusion of ext. carotid; this was accordingly ligated immediately above bifurcation. The establishment of a collateral circulation through the branches of the other side, as feared, did not occur. The swelling decreased in size immediately after operation, and 10 days later, except for the fracture, condition of patient was normal.

The case is of interest as showing the successful result of early proximal ligature in traumatic aneurism, even of a vessel forming such free anastomoses as the ext. carotid. This was probably due to the rapid development, which outran the widening of the anastomosing vessels and gave no time for a collateral circulation. In one of slower growth the result would probably have been different.

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(7) Lancet, Jan. 4, 1919.

Tracheotomy. A method *without loss of blood* is brought forward by D. Guthrie.[8] If the anatomic relations of the superficial and deep veins below the thyroid are appreciated, the trachea can be opened in the low operation with little or no loss of blood in most instances.

The ant. jugular extends down from the chin upon the mylohyoid and sternohyoid emptying into the external jugular or subclavian veins below the origin of s. mastoid. It anastomoses with adjacent veins and by a large arcus venosus juguli below the thyroid ($\frac{1}{4}$ to $\frac{1}{2}$ in. above the sternal notch with the vein from opposite side). It is this large arcus venosus which must not be injured in low tracheotomy. Lying deeply in the median region behind the sternohyoid and thyroid

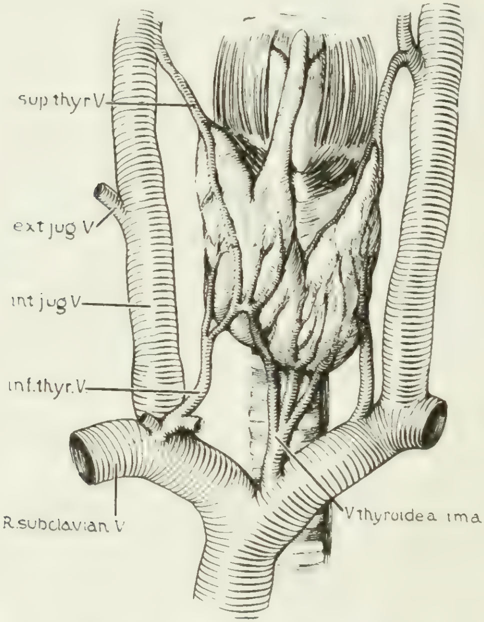

Fig. 95. Relations of lateral inferior thyroid veins, plexus thyroideus impar, and vena thyroidea ima diagrammatic (Guthrie).

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(8) Surg., Gynecol. and Obstet., September, 1919.

and at the lower margin of the isthmus of thyroid is an unpaired venous network from the inf. thyroid veins, the plexus thyroideus impar, which gradually empties into an unpaired vessel, thyroidea ima, descending in front of trachea and emptying into l. innominate behind the manubrium. In addition there is also a pair of lateral inferior thyroid veins, which collect blood from the lower portions of the lateral lobes, anastomosing with preceding vessels; the r. vein opens at the angle of junction of the innominate veins or into the right innominate or internal jugular, or subclavian. The l. vein empties into the innominate. These veins lie laterally to the trachea and are not encountered in low tracheotomy. The blood from the lower poles is collected by 3 unpaired venous branches. The thyroidea ima lies in the midline directly over trachea. It must be pulled aside by retractors before the trachea is opened.

To describe the operation he considers 3 different types of tracheotomy: 1. The preliminary operation in which the patient can be anesthetized and a careful dissection carried out. 2. In the pulling patient, who needs tracheotomy and not intubation, or in whom intubation has failed to relieve the obstruction. Time can be taken to operate on these patients under local anesthesia. 3. The extreme case on the point of asphyxiation, who is struggling and fighting for breath. and must be operated upon without anesthesia. In types 1 and 2 little or no blood need be lost if the relation of the veins is appreciated. In the third, if the thyroid ima can be pulled aside successfully no blood need be lost. If patient is a child it is wrapped in a blanket to control struggling and placed upon the table. A pad is put under shoulders and head is hung over the end of table—steadied by assistant. The operator stands on r. hand side of table and steadying the skin with the left hand, makes an incision in midline 1½ to 1¾ in. long. The incision should not extend down to sternal notch but must end ½ in. above it to avoid the arcus of ant. jugular veins. The skin and superficial fascia are incised, and wound held open by a pair of catspaw retractors which should not be over 1 in. broad. The parallel branches of the ant. jugular veins escape injury if incision is made in midline because they lie to either side of it. The sternohyoid and thyroid muscles are separated by blunt dissection. If care can be exercised during this step, they can usually be separated without injury to the thyroid ima beneath. The retractors are reset. ·The l. blade holds aside the skin, fascia and the two muscles; the r. blade holds the skin, fascia, muscles and the thyroid ima. This exposes the trachea. It is incised, the head is straightened, and the tube inserted. This method has been employed 12 times in hospital, twice in home.

Esophagus. Reporting *2 esophagotomies in children,* each 2 years old, for foreign bodies, Colledge and Ewart[9] draw attention to the following points:

An attempt at removal by the esophagoscope should always be undertaken first, since it is nearly always successful. Even if unsuccessful it reveals the true level of the foreign body, on which point the *x*-rays may be misleading. When the mechanical problem of endoscopic removal is found to present apparently insuperable difficulties it is much safer to make a clean incision in the esophagus than to risk its laceration or perforation of the carotid sheath by persistent efforts to remove by the endoscope. The esophagus, when exposed thus in the living child, is cylindrical and not a flattened band as usually seen at a necropsy. By suturing the wound in the esophagus and lightly packing the outer part the risk of spreading cellulitis of the neck and mediastinitis is reduced to the minimum. Wounds do not heal readily, and it is futile to aim at primary union, but the tissues are thus given time to recover before leakage begins. As there is certain to be some leakage, however carefully the stitching is done, the child should be fed on sterilised liquids, avoiding milk. A clean vertical incision does not lead to subsequent stenosis. The first child operated on is in good health and swallows normally 5-, the second 4 years later.

A case of *resection of the esophagus for carcinoma,* which with one exception lived longer than any other, is placed on record by A. J. Bengolea.[1] The patient

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(9) Lancet, Oct. 25, 1919.
(1) Surg., Gynecol. and Obstet., October, 1919.

a woman, of 37, had symptoms for 16 months previous, and for 20 days even fluids could not be swallowed; weight 77 lbs. Tumor situated 13.2 in. from dental arch. The operation which lasted 150 min. consisted of esophagogastrostomy. On removal of the tumor a wooden bobbin was placed in the esophageal opening

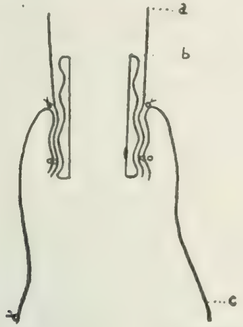

Fig. 96. **Esophagogastrostomy:** *a*, esophagus; *b*, bobbin; *c*, stomach; ***d***, **diaphragm (Bengolea).**

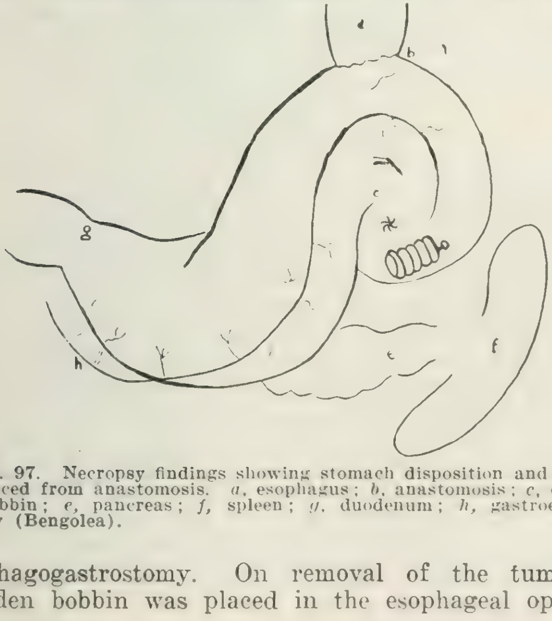

Fig. 97. Necropsy findings showing stomach disposition and bobbin displaced from anastomosis. *a*, esophagus; *b*, anastomosis; *c*, cardia; *d*, bobbin; *e*, pancreas; *f*, spleen; *g*, duodenum; *h*, gastroepiploic artery (Bengolea).

and fixed by a catgut pursestring. The portion of the stomach pulled up into the thoracic cavity was opened at the point of least traction and as near as possible to the greater curvature, and was then placed in the esophagus in which the wooden bobbin had already been placed. By pursestring, as shown (figure), the stomach was fixed to the lower groove of the bobbin. The anastomosis was later strengthened by continuous gastroesophageal suture which protected and invaginated the esophageal stump. The diaphragmatic wound was closed and the stomach fixed by interrupted suture to the diaphragm. The thoracic wound was closed after free incision in the 10th space for drainage of the pleural cavity.

Survival for 37 days. Necropsy showed 150 grams of a purulent fluid and some membranous exudate within the pleural cavity. The pleura was thickened throughout and an inflammatory exudate present. The lung was very much retracted, shrunken, and fixed anterioriy to pleura. The esophagogastrostomy was isolated from the pleural cavity by a portion of the base of lung, and this adhesion was probably the cause of the anastomosis not closing absolutely.

THE THYROID.

Wounds. H. Alamartine[2] had under his care *3 wounds of the thyroid:* (*A*) Man, aged 42, for several years had a small median goiter without clinical manifestations. Kicked by mule in neck, extra- and intrathyroid hemorrhage, serious compression of trachea. Removal of one-half of the polycystic gland, recovery. (*B*) Seton bullet wound, involving left half, deep hematoma. Hemostatic suture, recovery. (*C*) Shell wound, with impaction of fragment. Deep hematoma, intractable bleeding externally, partial thyroidectomy, recovery.

In these cases the source of the bleeding is the arterial branches, the veins, or the cut section of gland itself. The arteries are isolated and tied; also the capsular veins, but in latter both ends must be ligated, as these are often retracted it means careful search. For bleeding from the

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(2) Presse Méd., Feb. 27, 1919.

gland tissue, tamponnade or cautery is out of the question; the only means is mass closure by U-shaped sutures of large gut. Plenty of room is necessary, and if need be the gland can be partially dislocated outward.

For simple wounds, cutting instruments, or seton bullet wounds, the operation can be very conservative. After double ligation of the vessels in the capsule, the margins of wound are trimmed up, and brought together by the U-sutures. A few stitches in capsule complete intervention. A small gauze drain is left against suture line for 2 or 3 days. The superficial tissues are closed nearly completely. If operation is delayed so there is infection, the same hemostasis is carried out, but the suturing of the gland should not be so tight, and a large drain installed with irrigation if necessary.

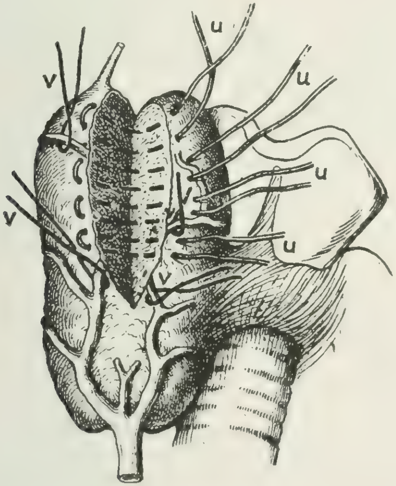

Fig. 98. Hemostasis for wound of thyroid, *v,v,v,v*, capsular veins tied separately; *u,u,u,u*, hemostasis of the parenchyma by U-shaped sutures of strong catgut (Alamartine, after Bérard).

Goiter. A survey of *thyroid enlargement among pupils of an Indian school* was made by W. J. Kerr.[3] There were 198 boys and 192 girls, representing 43 tribes,

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(3) Northwest Med., June, 1919.

while 171 were full-blood. Only 310, however, were examined, and 33 showed definite enlargement. Most of these (23) were in pupils of 12-15, only 6 were males, and 14 tribes were represented.

In the 33 observed enlargements there were 22 cases described as slightly- 8 as moderately- and 3 as marked enlargement. The isthmus was involved alone in 19, the isthmus and right lobe in 2 and a diffuse, even enlargement in 12. The consistency was given as soft in 21 and firm in 12. A tremor was noted in 12 of the 33. No distinction was made between a coarse or fine tremor. A distinct curving of the nails, anteroposteriorly, was noted in 14 cases. The presence of vasomotor instability was difficult to determine because of the color, but was noted 5 times. The pulse (standing) averaged 85. In full-blood Indians the incidence is very low compared with part blood, or pure Caucasians.

	Enlarged Thyroids.	Students in School.
Full-blooded Indians	3	171
Three-fourths blood	3	50
One-half blood	7	68
One-quarter blood	14	92
One-eighth blood	6	9

[''Lo! the poor Indian,'' as he was poetically designated by the late Mr. Pope, has always been pointed out as an example of the benefits from fresh air and outdoor-life. But, of late years, he has not been found immune to the ailments which afflict other races. Goiter, *e. g.,* is widely distributed, though seldom prevalent, according to Hrdlicka—''Handbook N. Amer. Ind.'' I, p. 541.—Ed.]

The pathology of goiter is elaborated by B. T. Simpson[4] based on specimens sent in to the N. Y. State Institute. Buffalo, in common with other cities on the southern borders of the Great Lakes, is considered a goitrous region although it has only the incipient endemic goiter and rarely as marked as that common in the European goitrous regions. The specimens of enlarged thyroids which come to the laboratory for diagnosis can be classified into 5 groups: simple goiter, multiple adenomata,

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(4) Surg., Gynecol. and Obstet., February, 1919.

colloid goiter, exophthalmic, malignant neoplasms. These are all characterized by the common factor of enlargement but otherwise differ markedly from one another. They may be differentiated clinically in nearly all cases by careful examination which seems to be desirable for the selection of proper treatment.

The physiologic simple goiter is simply a vascular dilatation and is goiter only in the sense of the enlarged gland which, however, is often only of temporary duration. Simple toxic goiter is due to a symmetric hyperplasia of all the structures of the thyroid and without the clinical evidence of toxic symptoms, most probably caused by toxic factors. This form which is usually called endemic goiter is almost always associated with drinking water which probably has to do with carrying the infection or toxin.

Multiple adenomata is the most common cause of thyroid enlargement around Buffalo, at least based upon material sent in to the laboratory. It is a true tumor formation, beginning probably in remnants of embryonic ducts occurring about puberty. These tumors start as minute adenomata in different parts and gradually increase, causing the nodular form seen in later life and having a great tendency to the so-called degenerative changes which give this form its numerous names. It is well to remember that these adenomata when very cellular may give toxic symptoms and thereby become confused clinically with exophthalmic goiter.

Colloid goiter is simply a passive accumulation of colloid material in the dilated alveoli and it is usually considered a healed state of some previous condition.

Exophthalmic goiter, even if it be not of primary thyroid origin, has its specific pathognomonic histologic picture, and there can be no doubt of the toxic effect of the excessive secretion of this gland.

Some 5% of the specimens received showed a combination of some of these lesions, *i. e.*, colloid goiter may show adenomata and a large adenomatous goiter may show areas of true Graves' disease. This may explain that certain unfavorable results may be due to leaving part of an area of exophthalmic goiter in the removal of an adenoma or of a colloid lobe.

Surgical Treatment. Some *unsettled points in the surgery of the thyroid* are alluded to by M. Ballin.[5] His last 200 goiter cases show a mortality of 1½ per cent. Three cases died; an advanced case of Graves' disease, after resection; a malignant goiter and one from collapse of trachea after removal of a large retrosternal goiter.

There are a few questions which remain unsettled, or at least are answered not equally by different surgeons: (I) The question what to do with large goiters where several more or less large cystadenomas are present in both lobes or the whole gland is permeated by many small colloid cysts forming a goiter that looks more of a general parenchymatous enlargement. (II) This is still more important; how to treat surgically, the many serious cases of exophthalmic goiter.

I. For these cases it has to be remembered that a total thyroidectomy cannot be done on account of the danger of myxedema following. The rule is to leave ⅖, or after others, ⅗ of the gland. If we would simply follow this rule and *e. g.*, remove one lobe, isthmus and a part of the other lobe, we would usually leave a thyroid rest, with small or large cysts. Such cystic remnants will in the first place, look badly; the patient will not be satisfied. Then such cysts grow, by no means infrequently, especially in the line where the gland was resected, to large tumors, requiring another operation. Ballin had such secondary operations for enlargement of small cyst left in the primary operation, about 10 times. To overcome this difficulty, 2 methods must be borne in mind: first, a so-called plastik resection. It consists briefly, of first freeing the isthmus from the trachea, separating the lobes at the middle of isthmus and then taking out from each lobe a cone-shaped piece. A second method for these diffuse goiters is founded on the fact the upper poles where the superior vessels enter are usually free from cysts; therefore Ballin has often tried to save the good glandular tissue on one or both upper poles while removing all the other cyst-bearing parts.

II. Since it was recognized that Graves' disease is due to increased function, operations have been done to decrease this function. (*A*) By cutting away part of the

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(5) Jour. Michigan State Med. Soc., December, 1918.

gland—*i. e.*, either thyroidectomy or resection. (*B*) By diminishing the blood supply through ligature of one or more thyroid arteries or pole ligature. (*C*) By destroying some tissue by *x*-rays, radium or hot water.

In a secondary case, the patient has carried a goiter for some shorter or longer period of time and suddenly, due to irritative changes, symptoms of thyroidism, tachycardia, nervousness and not so frequently eye symptoms, arise. In the primary type we have a more general enlargement without any adenomatous formation and the cell- and colloid changes characteristic of Graves' disease permeate the whole gland. The goiter appears nearly simultaneously with the other symptoms. The secondary type, even with a pulse of 140, will always stand a radical operation, *i. e.*, removal of the goiter. Not so the primary type—which, when well developed, will not stand undue handling. If the primary type has a pulse over 140, great restlessness and disturbances of metabolism, the excisions carry with them the great danger of succumbing to postoperative thyroidism. To overcome this danger, lesser operations, ligature of arteries, poles of the gland and hot water have been recommended. The pole ligature or ligatures of arteries is always only a small step toward the cure. The condition improves somewhat but relapses will always follow. The same can be said about hot water, and it seems the fatality in serious cases of thyroidism where this method was employed, is very high. It is not the innocent method that it appeared to be. Hypodermic injection does not sound like operation, but still may be more dangerous.

For serious cases of primary Graves' disease Ballin has practiced "transfixion of the gland": Expose the gland by a small transverse collar incision separating the straight muscles of the neck. After the gland had been exposed, a No. 2 chromic gut stitch is run through the gland continuously or interrupted so only the gland tissue proper is pierced, without infringing on its posterior extracapsular part of the gland where the inferior thyroid enters, the laryngeal nerve and parathyroids are located. The idea is along this chromic gut, the glandular tissue is replaced by scar tissue and herewith the secretory part of gland is diminished. The reducing influence of this transfixion seems to be much greater than ligature of one or two arteries, which is clear if we consider how well the gland is nourished from two arteries—a supply that is only equaled by that of brain.

Start suture close to the r. or l. upper pole like a pole ligature. Keeping the left index protecting posteriorly, go through the gland taking as large masses in stitches as possible and always including the accessory veins. In this way we also interfere with venous circulation of the gland. This interrupted stitch can be carried through both lobes without the danger of getting myxedema as we get only fibrous streaks on the places of suture.

The method is so efficient, that in Ballin's oldest case (1909), a very pronounced one with every sign, exophthalmus, tremor, goiter, etc., he would challenge anyone to diagnose Graves' disease today. Lately he has closed most of these wounds simply by letting the sterno-thyroid and hyoid fall together in the midline fastening them with two or three not too tight catgut sutures and then stitching the platysma, fascia and subcutaneous fat by a running catgut stitch and uniting the skin with clips or silk without any drainage. From this method he had very little postoperative thyroidism, often nearly invisible scars and in most cases very gratifying results. In 200 cases he has applied this method 26 times for primary Graves' disease, none died. Several are cured completely or so close to a cure that no further operation is indicated. Only in one, after a primary improvement, recurrence ensued, and this patient is now nearly cured by a second transfixation.

Concerning *the indication for surgical treatment of the thyroid,* G. Earl[6] suggests that before directly attacking the thyroid and accepting for the immediate and simple indications it should be considered a barometer, that there is something wrong elsewhere in the body, mode of life, or thought, or diet, and a most thorough search for etiology made. Scientific investigation along basal metabolism and the chemistry offers our greatest hope for new advance in diagnosis and treatment.

Surgeons who constantly keep in mind the adolescent

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(6) Minnesota Med., August, 1919.

and soft type goiters, consider all etiologic factors, seek a careful differential diagnosis, do the stage operation, reckon none more grateful than their thyroid patients. Such conditions as simple cysts and adenomas markedly outlined, resolve themselves into a question of pressure or mental attitude of the patient. The rare cases of abscess, carcinoma, and the fulminating thyroidism, subject themselves to the usual surgical indications. Where the overactivity of the gland or the toxic elimination from its pathology is great even if there were some method of wearing it out, the damage by that time to the rest of the body will be irreparable. In these cases given the selection of the proper time as to ebb and flow, and the proper preparation, intervention is as much indicated as in an acute ruptured appendix. One cannot help but think of Nature's response in the form of peritonitis being an effort to attack the cause, but the strength of her response is at times so great that it itself becomes an evil, and Crile points the need of restraining this overaggressiveness by morphin and other measures. So with the thyroid it may be that Nature in order to combat an evil sets in motion an overactivity which gets beyond its control and return to normal function before irreparable harm to the body is done is impossible without the knife.

N. J. MacLean[7] takes up the *treatment of exophthalmic and thyrotoxic goiter,* with special reference to bilateral resection. There is no unanimity regarding the surgical procedure. Thus, Rogers claims 70 per cent. cures from ligation of the 4 thyroid arteries. Walton says hemithyroidectomy is the choice. Others, as Kocher, the Mayos, and Ochsner do a lobectomy with or without partial resection of the remaining lobe.

Since 1912 MacLean has done bilateral resection on 31 cases of true Graves' disease, or cases with positive symptoms of hyperthyroidism where both lobes were enlarged. All cases operated upon that did not have definite tremor and tachycardia have been excluded. There was no operative mortality in this series. His mortality for goiters of all types was 1; Graves' disease in which a single lobe was resected before the patient had sufficiently

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(7) Surg., Gynecol. and Obstet., November, 1919.

recovered from an exacerbation of symptoms. One other case died following injection of boiling water, an extremely severe type. The advantages of bilateral resection over unilateral lobectomy or unilateral lobectomy with partial resection of the opposite lobe are: 1. Minimum injury to the parathyroids. 2. Absolute safety for the recurrent laryngeal. 3. If for any reason further removal of gland should be indicated, *e. g.*, for recrudescence of symptoms of thyrotoxic activity, or the rare but possible occurrence of malignancy, the one side could now be completely removed with an assurance that some portion of gland remained. 4. It is a physiologic fact that where there are paired organs, should one be removed the other undergoes hypertrophy. This, while desirable where one is normal, is what we wish to avoid in the case under discussion, and this end is best obtained by double resection. 5. Finally, for cosmetic purposes, in lobectomy there is a well-marked depression on one side, and on the other the portion of gland left produces an undue prominence, while in bilateral resection the neck is obviously symmetric. (Plate XI.)

Regarding *preliminary ligation in hyperthyroidism*, F. H. Lahey[9] wishes to say that to surgeons experienced in thyroid surgery, the warning, ''Ligate when in doubt,'' is unnecessary; they have either been aided by the procedure in maintaining a low mortality, or have been forced to it by a high mortality. To men experienced in general surgery, but not particularly in the surgery of hyperthyroidism, the warning, ''ligate when in doubt,'' will prevent many a distressing table death, and but few calamities are more harrowing than a death on the table while operating for hyperthyroidism. To the ''now and then'' operator, he would only say, if your conscience permits you to operate upon hyperthyroidism, preliminary ligation is one of the ways in which the mortality rate in partial thyroidectomy can be lowered.

Local Anesthesia in Goiter Operations. This is touched on by S. H. Rouquette.[1] Of the various methods the rectal is achieving popularity, but such experience as he has had has only served to strengthen his preference

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(9) Boston Med. and Surg. Jour., Nov. 20, 1919.
(1) Lancet, Dec. 7, 1918.

for local anesthesia. On several occasions ether by the intratracheal method was given with great success, but while most suitable for large, simple goiters with respiratory embarrassment, it is limited.

It was with a view to improving the technic and alleviating the distress during operation that Rouquette began to use preliminary injections of morphin and later of hyoscin as well. For each individual it is necessary to estimate what dose will be required and how long it will take to produce the desired effect. Most frequently hyoscin 1/100 gr. and morphin 1/6 gr. 90 min. before operation and morphin ¼ gr. 30 min. later. The ears are plugged with wool and the room darkened at the time of first injection. The injection can be made through one median puncture, and as introduction of a large spinal needle is painful, it is well to begin by infiltrating the puncture area with a fine hypodermic needle. All the tissues superficial and lateral to the gland can be infiltrated, but the fluid does not penetrate the capsule and seldom reaches the trachea; posteriorly the structures never show any evidence of infiltration. The injection is begun 30 min. before operation while patient is still in bed; he is then conveyed to the operation theatre, and by this time is usually drowsy. It is not nècessary to inject any more of the novocain solution during the operation.

Rouquette always drains the wound and closes the incision with clips; the tubes and some clips are removed in 2 days and, if the wound then shows no tendency to gape, remaining clips are removed on following day. In the majority, the patient altogether escaping the physical and mental distress so apt to follow general anesthesia. The narcotics produce no ill-effects unless in excessive doses when headache and thirst may be complained of; headaches readily alleviated by aspirin and thirst by fluids in any form most palatable. The temperature is always raised for a few days, but usually no higher than 101° F.; in some cases and for no apparent reason it remains irregular for 2 or 3 weeks, and then slowly falls to normal, provided absolute rest is enforced. The pulse reaches its highest on 2d day, and thereafter falls steadily during the next 10 days to below that before the operation. The wound nearly always runs an aseptic course and heals by first intention, but a hematoma is not unlikely if more than 0.1 per cent. adrenalin 20 *m.* has been used in the solution. Occasionally alarming symptoms call for prompt treatment. Great acceleration, and particularly irregularity, of pulse indicate fatigue, when an effort should be made to induce repose of body and of mind; paraldehyd in rectal saline will often bring about a marked improvement. If, in addition, patient is dyspneic, cyanosed, and restless the condition is more serious; the wound should first be examined to make sure drainage is not obstructed, and then strophanthin should be injected intravenously; the effect of which is instantaneous. Inhalation of oxygen is sometimes useful in relieving cyanosis.

A. A. Keller[2] states during 5 years at the Charity Hospital (New Orleans) there was a total of *149 operations for goiter*, 104 under general anesthesia. Of the 45 operations under local anesthesia, 11 were vessel ligations, 2 bipolar ligations, 4 lobectomies, 4 complete thyroidectomies for exophthalmus, and 24 complete thyroidectomies for simple cystic colloid goiter. A few vessel ligations were done under Schleich solution, 2 complete thyroidectomies for cystic goiter with apothesine, and the rest with novocain.

A study of goiter based on 1000 operations is made by E. P. Sloan.[3] Simple 493 (219 with some pressure symptoms). Typical exophthalmic, 132 had no palpable or visible enlargement, 39 had pressure symptoms.

There were 280 cases of hypothyroidism, thyrotoxic and mixed. The mixed were toxic and hypothyroidism or toxic and hyperthyroidism. Of these 280 cases 184 had tumors of the gland. In 96 no tumor or enlargement was visible or palpable upon examination but in every case tumor growth was found to be present at the operation. Some 197 of the 280 had some pressure symptoms. So 455 of the 1000 had pressure symptoms.

The youngest was 7, the oldest 69. Some 327 were unilateral, 673 bilateral, 748 had hereditary history, 77 intrathoracic projections, 141 substernal or subclavicular projections, 119 had previously received serum treatment,

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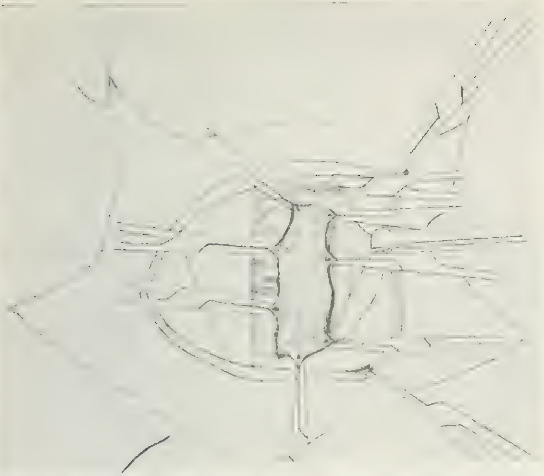
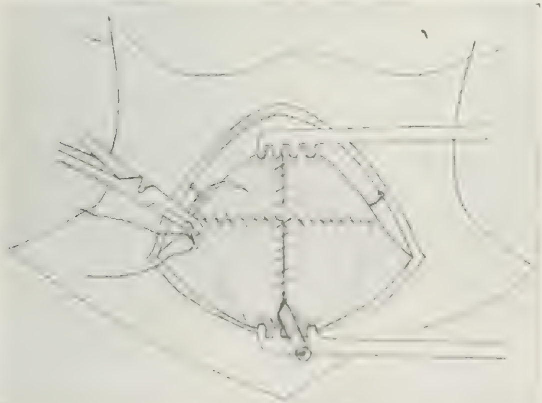
(2) New Orleans Med. and Surg. Jour., January, 1919.
(3) Illinois Med. Jour., May, 1919.



Clamps applied to the vessels in capsule and part of gland in front of them cut away. The recurrent laryngeal nerve is shown but does not come into view in operation.



Infrahyoid muscles sutured and tube inserted at lower angle. When tube is brought out through a separate stab a very noticeable scar remains. It is best brought out through the incision made, and the scar is easily covered by small necklace. MacLean. (See p. 285.)

3 were malignant, 326 had exophthalmus. Known to be tuberculous before operation, 79; suspected, 46. A diagnosis of endocarditis was made in 530, auricular flutter in 37, auricular fibrillation in 182, organic lesions of the heart, 166; 134 had a history of rheumatism followed by heart trouble. Almost every case with organic lesion of the heart gave a history of rheumatism years before the appearance of symptoms of hyperthyroidism. Sloan does not remember of having seen a heart affected by rheumatism after a goiter was present. One-half had endocarditis, not complicated by any other heart disturbance. The after-result has compared almost uniformly with the condition of the heart at the operation. Two patients were operated upon at the beginning of the 3d month of pregnancy, one at the beginning of the 4th.

Several years ago he noticed the removal of tonsils affected hyperthyroidism cases very favorably and for several years it has been his routine to remove the tonsils 16 to 21 days before operating upon all cases in which serious heart symptoms are present. In preparation of the serious cases for operation 177 received hot water injections, 32 received quinin and urea hydrochlorid injections; 409 received salvarsan. Twenty-seven ligations of the sup. thyroid and 31 of the inf. thyroid done.

Complications due to the operation: One patient has a bad scar. No injury has occurred to the recurrent laryngeal. Three parathyroids were removed inadvertently, 7 deliberately. No effect due to their removal was discovered. *After results:* Deaths, 4. Not improved or made worse, none. Still invalids but definitely better, 31. Satisfactorily improved, 431. Complete recovery, 533.

Recurrence. The return with the characteristic symptoms in a small percentage after the primary removal of $\frac{2}{3}$ to $\frac{4}{5}$ of the gland shows the etiologic factor must still be active. A study of the case histories of such recurrences has led H. G. Sloan[5] to believe in many instances, if not always, the exciting cause of exophthalmic goiter and of its recurrence will be found to be an infection—usually focal—which must be eradicated before cure is possible. In a year he observed 5 cases.

He has most frequently been able to locate the trouble

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(5) Surg., Gynecol. and Obstet., August, 1919.

in the naso-pharynx and mouth. Thus a history of recurrent sore throat with the presence of enlarged deep cervical nodes is considered sufficient evidence to justify a tonsillectomy, even though the tonsils may look normal when the anterior pillar has been drawn aside to make the patient gag. The condition of the teeth invites the closest scrutiny. If the presence of a root abscess is revealed by the *x*-ray, the tooth should be extracted. Temporizing with pyorrhea invites disappointment. The exposure to the *x*-ray of infected sinuses that resist all other treatment has given very good results. Sloan has found that even fulminating exophthalmic goiters will stand tonsillectomy under anesthesia better than one would suppose. Several days after the eradication of the focus, the superior thyroids are ligated, and patient sent home for carefully-planned dietetic regimen with complete rest for 2 or 3 months before the thyroidectomy.

Treatment by X-Rays. H. Harris[6] treated 52 cases, all but 2 in females. There were 39 exophthalmic goiters, acute and subacute. The result of the treatment has been most successful. Sometimes it is quite remarkable to see how rapidly the tremor disappears and the pulse slows down. The general condition improves rapidly, the appetite grows and the patient gains in weight. Where surgery has been employed postoperative Röntgen rays should be applied to the thymus area. Deep therapy should be employed in a cross-fire method. A filter of 1 mm. aluminum is employed, and the intervals between treatment carefully adjusted and gradually lengthened as far as is compatible with the symptoms and condition. Naturally, some cases may recur, and will then need a further short course. Therefore, "cures" should not be reported until a patient has remained well at least 10 years. Hypothyroidism is apt to develop after an operation, and also occasionally cases of hyper- change to hypothyroidism, even when no particular treatment has been adopted. The most that can be said is Röntgen ray therapy offers more hope of success than any other method, provided it be carefully carried out.

A much larger series of patients (262) with thyrotoxi-

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(6) Med. Jour. Australia, March 1, 1919.

cosis were treated by Holmes and Merrill[7] in the previous 5 years. These are arranged in 3 groups: (*A*) Apparently well, 34; 3 males, 31 females; ten over 35, five under 20. (*B*) Improved, 68; 3 males, 65 females; thirteen 36 or older, nine under 20, rest 20 to 35. (*C*) Unimproved or bad results, 14; all females; five over 35, none under 20. (In addition there were 133 who are not included because of insufficient data).

After this experience they believe it is possible to decrease the activity of the thyroid and probably to destroy its glandular structure by exposure to the ray. *X*-ray treatment in thyrotoxicosis produces a relief of symptoms and shortens the course. A study of the basal metabolism before, during and after treatment is of the greatest importance both as a means of diagnosis and as a check on the amount of treatment to be given. *X*-ray, accompanied by rest, should be tried in all cases of thyrotoxicosis and be continued for a sufficient time to destroy at least the thymus before resorting to surgery.

THE MAMMA.

Cancer. D. A. Orth[8] reaches conclusions as follows concerning *mammary carcinoma:* *A*. Complete and early removal of the primary focus together with all other tissues that are or are suspected of being involved. *B*. Performance of the operation so the incisions or manipulations shall not carry the carcinomatous material into lymph-vessels, veins or healthy tissues. *C*. Thorough and competent treatment of the operative field as well as all possible sites of metastases both before and after the operation with rays. No incision should be considered which in any way limited the removal of as much skin as might be suspected of being implicated in the carcinomatous process. The tumor should be taken as the center of the incision and not the nipple. In cases where metastases had occurred, necessitating extensive removal of the integument, no attempt should be made to close the wound by traction. Skin grafting should be resorted to later

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(7) Jour. Amer. Med. Ass'n, Nov. 29, 1919.
(8) Bull. Chicago Med. Soc., April 12, 1919.

but not at the operation because of the imperative use of the x-rays following operation, which might kill the graft. The better procedure was to cover denuded area with strips of adhesive (Beck), promoting epithelization.

The incision described by Rodman permitted immediate closure and should therefore be used whenever applicable. The axillary dissection should be made so thorough that nothing was left but the long subscapular nerve on its posterior aspect, which should not be injured as it supplies the latissimus. When the cancer had advanced to extensive glandular involvement and possibly ulceration, the preferred technic was the use of the cautery knife, in which case it was immaterial whether the operation was made from axilla to sternum or vice versa.

As there is no positive way of determining whether a tumor is a cancer or not and all cancers in the breast are fatal unless removed, finally, that the operation for removal does not jeopardize life or invalidate the patient, all tumors of the breast should be removed at once. The removal of a portion at the operation for diagnostic purposes disseminates the tumor by metastases, if cancerous, to parts beyond removal at any subsequent operation and thereby results in death, such procedures are to be condemned. Inasmuch as malignant tumors are often devoid of subjective symptoms in the beginning, therefore it is our duty to inform the public as to their significance.

Opening the discussion A. J. Ochsner said cancer of the breast always started from a single point and if all that portion was removed in the primary operation the patient remained free. It was usually possible to trace the cancer back to some form of irritation, *e. g.*, a preceding tumor or a chronic inflammation. Consequently, whenever one of these irritating conditions was present it should be removed in order to prevent the development of cancer. He had encountered many hundreds of cases that started as harmless growths and could have been permanently removed if the principles insisted upon in Orth's paper had been carried out. He cited 2 patients operated on that morning, one a cancer in which a partial removal had been done some time before, and the other a benign tumor. He was convinced that the removal of the tumor would prevent the occurrence of cancer later, but had it remained he was sure that malignancy would sooner or later have occurred as the woman was 45.

He considered removal by the cautery knife very important in some cases. It had been shown experimentally that if a portion of cancer was transplanted after being subjected to 160° F. it would not grow, whereas a portion which was transplanted without being subjected to this heat would flourish in new surroundings. In advanced cases which seemed inoperable this method was very helpful; one patient had lived for 28 years after an apparently inoperable cancer was removed by this method. Ochsner thought this could be explained by the fact that the heat from the cautery carried for some distance from the cut and destroyed the cancer cells. It was known that cancer of the breast developed in five directions—through the trabeculæ toward the skin, through the lymphatics into the axilla and chest cavity, through the communicating branches into the other breast, and through the communicating channels into the cavity behind the neck, and the systematic operation used by Orth eliminated the spread to the greatest possible extent. In his opinion the early and complete operation was the most important of all.

H. T. Deelman[9] reviews *the outcome in 582 operative cases of mammary cancer* at the Amsterdam hospital, 1885 to 1915. There is at least an 8 per cent. difference in the mortality between the figures for a three year- and a five year-interval. Only 30.6% were still living five years after the operation of the 245 patients operated on 1885-1911. Only 33% of the total operated on were living at the fourth year, and of those who died in the interim five out of every six had succumbed to cancer or its consequences. A marked change for the better appears from 1900 onward, and systematic postoperative raying seems to be improving conditions lately even more. Of the women operated on in 1900-14, over 42% are still living. The figures show further that the age between 40 and 50 offers the best chances for survival.

[See also Deelman's statistics on cancer in general in Holland—1918 volume, p. 170.—Ed.]

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(9) Tijd. v. Geneesk. (quoted in Jour. Amer. Med. Ass'n, Nov. 8, 1919).

THE CHEST.

A distinguished exponent of thoracic surgery, W. Meyer,[1] traces *its evolution (1904-18):* It is a little more than a century ago that a French physician, Itard, first described what he then, and later the medical world, called "acute pneumothorax." If one side of the thorax is wounded and the pleural cavity opened, a collapse of the lung is the immediate and inevitable consequence, except previously formed adhesions between pulmonary and costal pleura prevent. Now, what happens when the thorax is opened, *e. g.* by a stab wound in an intercostal space in an affray on the street? Immediately air rushes into the cavity and atmospheric pressure, being greater than the pressure within, compresses the lung. On account of its elasticity the lung contracts to a very small organ around its hilum. Air fills the space formerly occupied by the lung. This condition, with its immediate clinical consequences, is "acute pneumothorax." It has been the stumbling block for almost a century to proper development of surgery of the chest soon after a unilateral acute pneumothorax and its first violent sequelæ with reference to frequency and depth of respiration, dyspnea set in. This is principally due to the so-called "fluttering (or flapping) of the mediastinum." The latter, and with it the heart and large vessels, are pushed toward the unopened side, with each inspiration, on account of the increased atmospheric pressure over the exposed lung, thus reducing the space of the opposite pleural cavity. With expiration the mediastinum returns to its former position or is pushed further outward. The mechanism prevents proper inspiratory distension and the necessary expiratory collapse of the lung on the healthy side. In other words: besides the total collapse of the lung on the injured side, the normal exchange of the gases, also on the opposite side, is interfered with. Carbonic acid is retained in the blood, and this retention soon produces dyspnea and irritates the circulatory center which, in turn, increases the volume of blood in the collapsed lung. It usually does not last long before the one lung is unable to uphold the necessary function of

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(1) Med. Record, May 10, 1919.

life. The accumulation of CO_2 with its deleterious effect increases, finally ending in death.

We now have 4 useful methods for properly maintaining the "physiologic" working of the heart and lungs during operations: (1) the negative chamber and positive pressure box, (2) the mask apparatus, (3) intratracheal insufflation and (4) pharyngeal insufflation. But they all mean the application of either negative or positive pressure, nothing else, and, that only the use of the differential pressure method,—no matter what the apparatus—enables the surgeon to work in the thorax with the same equanimity and tranquillity as in the abdomen.

What do we ~~have~~ to deal with anatomically? The chest wall, the pleura, the diaphragm, the anterior and posterior mediastinum, the latter including the esophagus, the heart with the aorta and pulmonary artery, the lungs and bronchi. The thorax had been the domain of the internists as long as medicine exists. Thoracic surgery could not come forward on account of the acute pneumothorax. Now, at last, also this cavity had been safely opened to surgery. Real advance to cure many affections, hitherto inaccessible, could now be made. Meyer firmly believes that within a few years we shall have in every well-conducted hospital a reliable bronchoscopist and esophagoscopist, or if not every hospital should create this special position, one and the same specialist can serve a number of hospitals. But he must be a man of whom we know that he will not do harm in introducing the instruments, a man who is able properly to interpret what he sees, who, with the proper aspiration and irrigating apparatus, takes care that first all the secretion of the bronchial tree of the affected lung is aspirated, so he is able to diagnose from which bronchus and from which branch of the bronchus the pus is oozing. He will then be able to tell us whether one or more lobes are affected. We must be sure that he does not make a guess, but states what he has definitely seen. Therefore, bronchoscopy is of such vital importance in making a refined diagnosis in suppurating lung disease. The outlook for thoracic surgery is wonderful. What particularly is to be emphasized is, that the thorax today is not only open to surgery, but that it is "*safely*" open to it. Let us further emphasize the fact that today there is not one corner in our entire system that the surgeon's knife cannot reach. The thorax was the last fortress to be attacked, and it has been laid open safely to the knife by differential pressure methods.

One who has started work in intrathoracic surgery will never give it up. It is of such engrossing interest. However, in order to be successful, he should provide himself with proper apparatus and practice postoperative safe drainage. It is to be hoped that a constantly increasing number of men will enter upon this fascinating work. Many minds working in the same direction will get quicker results, for the benefit of suffering humanity.

M. Infroit,[2] the radiologist, calls attention to the frequency of *chalky concretions of the lung,* broncholiths, etc., the 3 plates shown were all gathered in a month. It is impossible to differentiate the shadows from those of small foreign bodies. He cited one man, wounded by several fragments, who had a diagnosis of a shell fragment in l. lung made at 6 different hospitals after *x*-ray and fluoroscopy. Of the 2 wounds of chest, one was over midsternum, and a small piece, size of bean, removed from under skin. The other in r. axilla, had no wound of exit, and the shadow was thought to be from another fragment. As there was pain on l. side, extraction was deemed necessary, and with aid of his compass, it was removed from lung at a depth of 1.6 in., but proved to be a chalky concretion. A few days later, another examination showed no shadow.

Technic. The *aspirator* designed by H. Robson[3] consists of a valve chamber *A*, attached to the ordinary aspirator bottle; the negative pressure in the bottle, being produced with a syringe connected by tubing to the valve chamber; no exhaust pump is needed, the instrument being so designed it will work with any ordinary syringe, such as an ear syringe. The valve chamber having been connected with the syringe, the stop-cock *E* is turned off; the syringe is then used as a pump; on pulling out the piston the ball valve *B* rises, and air is extracted from the bottle; at the same time the ball valve at *C* is sucked

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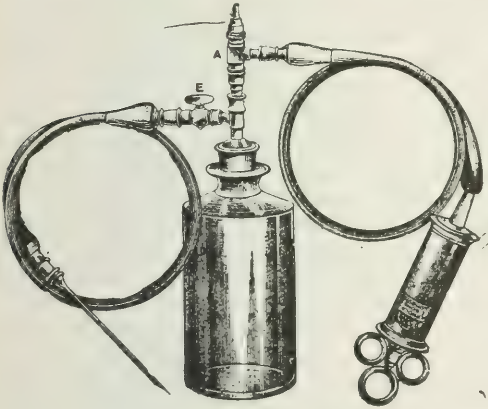
(2) Bull. Acad. de Méd., May 6, 1919.
(3) British Med. Jour., Aug. 16, 1919.

down, preventing any air entering the syringe from this part of the valve chamber. On pushing back the piston the ball valve at *C* rises and the air in the syringe is expelled at *D*, no air entering the bottle on account of the ball valve *B* falling and being held tightly in position by the suction in the bottle. As the pumping proceeds air is continually sucked from the bottle and expelled at *D*, a very high degree of vacuum being produced in the aspirator bottle. No tap is required between the valve chamber and the bottle, the ball valve *B* acting automatically seals the opening from the bottle, thereby preventing any loss of vacuum. There is nothing to get out of order, and the parts take to pieces and can be readily sterilized. The valve chamber can be detached and used where suction is required, as in Bier's treatment; attached to a suitable glass receiver it makes a powerful breast pump. The exhaust at *D* may be used if required as a continuous force pump for either liquids or gases.



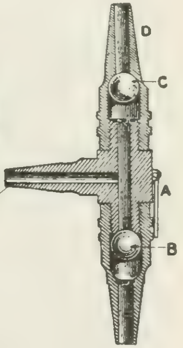


Fig. 99. New aspirator.
Fig. 100. Same, valve chamber (Robson).

Gunshot Wounds. A physician, J. A. Nixon[5] makes some *remarks on chest wounds,* which are of interest since they take up the topic from the viewpoint of an

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(5) British Med. Jour., April 5, 1919.

internist who was associated with several master-surgeons—Duval, Gask, Lockwood, *et al.*

Duval's famous dictum, "the general rules of surgery must be applied to wounds of the lungs," came home at times with additional force. In the early stages of chest wounds the physician's first work is to help the surgeon to select cases which require, and are fit for, immediate operation or resuscitation. He has to decide at once with the surgeon and radiographer (1) whether the patient needs immediate operation. If so, why? (2) Can he stand immediate operation? If not, why not?

The patient may be *unfit for operation* owing to intrathoracic injuries, severity of the external or complicating wounds, loss of blood, collapse or shock.

It is the physician's province to decide as to the intrathoracic injuries, and he must form a definite opinion on the following points: Is there a sufficient degree of pneumothorax, hemothorax, collapse of lung, laceration or hematoma of lung, injury of heart, pericardium, or great vessels, injury of diaphragm, injury of vertebræ or cord, to account for the severity of symptoms? Radioscopy and radiography are almost indispensable to reach a correct conclusion, but it will sometimes happen the condition will not permit of *x*-ray examination.

When this is so, the question is rendered easier rather than harder. The patient is unfit for any immediate operation save one of the following: Immediate rapid operation for the arrest of visible hemorrhage from the chest wall or thorax, arrest of hemorrhage from coexisting wounds, aspiration for relief of pneumothorax (usually valve pneumothorax), aspiration for relief of hemothorax, temporary closure of open pneumothorax. Apart from one of these procedures, there remains nothing else than measures for resuscitation.

It is surprising to find how little attention is paid to the amount of expansion or air entry into the lungs in examining gunshot wounds of the chest. Yet this is of vital importance to the patient. Pleural friction must be carefully watched for. It is often the first sign of intrathoracic infection. But a small hemothorax almost always at an early stage produces friction which is of no great moment. Pericardial friction is not uncommon, but pericarditis is not necessarily a fatal or even a serious complication.

A heart beating in surgical emphysema of the substernal tissues may give rise to a friction sound indistinguishable from pericarditis, or to a remarkable churning sound mistakable for hemopneumopericardium. An adjacent pneumothorax will give to the normal heart sounds an exaggerated resonance or reverberation, and if friction is present either from pericarditis, or from surgical emphysema, or from hemopneumopericardium, the noises which may result are astonishing, although with experience they become unmistakable.

As a rule the exocardial friction sounds which appear immediately after wounding are due to surgical emphysema, and are very loud and coarse. True pericarditic friction usually comes on later and insidiously. It begins faintly over a limited area and spreads gradually with increasing loudness. Hernia of the stomach or intestines may cause gurgling sounds to be heard in the chest, but this sound is not diagnostic of a lacerated diaphragm. Intestinal gurgling is sometimes transmitted very distinctly through a pneumothorax with the diaphragm intact, and it is also heard when the diaphragm is raised abnormally high. It is very difficult to interpret correctly changes in the heart sounds and rhythm. Bruits which are mistaken for endocardial murmurs are produced by displacement of the mediastinum with dislocation or torsion of the heart and great vessels. Irregularities in rhythm may be similarly caused. Speaking generally, a heart which has been hit, with or without penetration, takes on a rapid and irregular action, especially if struck on the posterior aspect or near the auriculo-ventricular junction. Nixon has, however, seen a case with a shrapnel ball in the ventricular muscle near the apex, and another with a fistulous opening through the chest into r. auricle, yet in neither was there interference with the action.

Concerning the *surgical aspects of gunshot wounds of the chest,* G. E. Gask[6] believes the great lesson of the World War is a clear conception of the evolution of a wound. It is now clear that nearly all wounds

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(6) British Med. Jour., April 12, 1919.

are contaminated. It is equally clear there are some hours between the contamination and infection; *i. e.*, before the organisms have had time to multiply and invade the tissues. If infection is allowed to take place the man runs the risk of death or prolonged illness from septic processes. It has also been abundantly proved that antiseptics by themselves are of little value in preventing sepsis. The correct method, whenever practicable, is to excise the wound in the latent period, removing foreign bodies of all kinds. After this complete mechanical cleansing the wound should be closed and patient kept at rest.

The advance in thoracic surgery is due to the application of these principles to gunshot wounds. Early in the war little was done beyond dressing or strapping the chest wound, propping the patient up in bed, and giving him some morphin and a cough mixture. Under this treatment it is true many recovered, but many died and many had a tedious convalescence. The reasons for non-intervention were: 1. The experience of the Boer war led one to think that chest wounds were best left alone. In that war conditions were different. Wounds were mostly due to bullets, the climate was dry, and the soil relatively clean. In this war infection was the rule rather than the exception. 2. It was thought highly dangerous, if not fatal, to open the chest without some sort of pressure chamber, too cumbrous for field work. 3. It was believed that handling the lung might provoke renewed and fatal bleeding. All these objections have proved fallacious.

The *mortality* from chest wounds was high. Apart from deaths due to complicating wounds the fatal cases, as they appear to the operating surgeon, fall into 3 main groups: 1. Deaths a few hours after admission to a C. C. S. These are generally due to extensive and severe injuries, combined with loss of blood and shock. Few only can be saved, though with improved resuscitation methods and transfusion the percentage improved. 2. Deaths in 2 to 3 days. These are almost always due to sepsis of the pleural cavity and its contents. 3. Deaths at the base. Sepsis is again the almost invariable cause.

Having found out that the preventable cause of death was essentially due to infection of the pleural cavity, it was necessary next to discover the *channels of contamination:* 1. By the missile and portions of clothing or equipment carried in with it. Indriven splinters of rib are a factor both of causing and maintaining sepsis. 2. Through the wound of the chest wall. A wound which leads directly into the cavity and through which air is sucked at every breath will always lead to infection. Further, even a small wound, through which air is not being sucked, unless cleansed by operation, may suppurate in a few days, and unless the thorax has been sealed off by natural means microbes pass through into the pleura, where they find the hemothorax a good breeding ground. 3. From the wound of the lung itself in which a foreign body may be retained.

There can be no dispute now that the duty of the surgeon is to (1) Arrest hemorrhage when necessary; (2) resuscitate collapsed cases; (3) when required, to cleanse the wound of the chest mechanically.

As regards *application in civil life:* 1. The treatment of crushed chests. When associated with severe laceration of the lung by indriven fragments of bone, thoracotomy may be of service. 2. Can we use thoracotomy for intrathoracic carcinoma of the esophagus? Meyer of New York issues a very urgent warning, believing that patients wasted with malignant disease of the esophagus are much more dangerous for thoracotomy than the vigorous soldiers. 3. Can we improve the treatment of empyema? Gask suggests in certain cases, particularly children with a pneumococcal empyema, the cavity may be washed out and the chest closed without a drainage tube. This method has been performed successfully, and in picked cases may prove beneficial.

[See also Gask's paper, 1919 volume, p. 343.—Ed.]

S. W. Curl[7] has studied *contralateral signs in gunshot- and other chest injuries.* After experience in 60 cases, he believes these signs are common. Contralateral collapse is quite common, and its causes are probably manifold. The combination of physical signs supposed to be characteristic of solid lung is extremely fallacious and uncertain, since fluid effusions may give rise to

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(7) Quarterly Jour. of Med., April, 1919.

identical signs. Examination by x-rays, although extremely helpful, is by no means sufficient for the differentiation of solid lung from pleural effusions. In the differentiation of solid lung from pleural exudates the only safe guide is the exploring needle, and even this may fail unless exercised with discretion. With a pleural exudate the heart is generally displaced to the opposite side, but in a small percentage a fluid exudate may exist on the side to which the heart is displaced, doubtless owing to the concomitant marked pulmonary collapse. One at least of the causes of contralateral signs simulating solid lung is the presence on the contralateral side of a pleural exudate, and this exudate results from a bruising of pleura by contrècoup.

Lebowitz and Nadler[8] furnish a report based on *276 penetrating wounds* admitted in a year to a base about 50 miles from the front. It is concerned with the care during an intermediate stage, from the admission from C. C. S. to the evacuation to England. From 6 to 30 days after injury.

At the clearing stations where chest injuries comprised about 2% of admissions, resuscitation, transfusion and any urgent procedures indicated were employed. Cases with indications for primary surgery were operated upon. Closure of sucking wounds, removal of foreign bodies, particularly large ones, repair of diaphragm, excision and repair of lung tissue, evacuation of blood from the pleura and closure of the chest wall by layers, were among the operations performed. These patients were held, if possible, at least 8 to 10 days or until they were in condition to travel to the base by ambulance train. When the admissions were very large, chest cases could not always be retained as long as was desirable.

They point out the mortality of penetrating chest wounds that reached the base was low (5.4 per cent.), due chiefly to sepsis, pocketed empyema and associated injuries. These patients require treatment in special wards. Cooperation of internist, pathologist, roentgenologist and surgeon is essential. Hemothorax is the commonest event in chest wounds. Early diagnosis of infection is the most important duty at the base.

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(8) Surg., Gynecol. and Obstet., November, 1919.

Simple hemothorax 175
    a. Remained sterile 148
    b. Became infected 27
Pneumo- and hemopneumothorax 71 (open 26, closed 45)
    a. Remained sterile 48
    b. Became infected 23
Miscellaneous cases 30
    Without evidence of hemo- or pneumothorax.

Thoracotomy for infected hemothorax is the most frequent procedure at the base hospital. Carrel-Dakin treatment for empyema gives good results. Primary intrathoracic operations with closure may be performed early after injury—in the British Forces at the C. C. S. —in properly selected cases with no more danger than abdominal operations. Of 21 cases operated upon and closed, 9 remained sterile. It would seem this type of case, in particular, should be retained longer than was customary, to insure safety and comfort in travel.

Eleven *wounds of lung were sutured* by M. Brau-Tapie.[1] There were 63 cases altogether:

(A)	Bayonet, inoperable, died..............................	1
(B)	Bullet wounds (no operations, 11; operation on parietes only, 13), all recovered..............................	24
(C)	Wounds from shell fragments—inoperative, 3 died; no operation 4, all recovered; parietal operations 20, 3 deaths; operations on lung itself, 11, with 5 deaths...	38

Since bayonet wounds seem to have been scarce, it may be added this wound involved 3d space on r., coming out through scapula. Man dead when he reached C.C.S., 3 hours later. Necropsy showed death was due to hemothorax from injury to upper lobe.

Of the 5 deaths following pulmonary operations, 1 was from hemorrhagic shock (in spite of 600 c.c. of blood), 2 from acute septicemia, and 1 each from hepatic intoxication, and purulent pleurisy.

He believes operation should be done, provided the surroundings are good, when the bleeding from lung keeps up, and when the size of the projectile is as large as or larger than an acorn. If it seems doubtful whether the missile can be reached through the wound of entrance and the wound of lung, anterior thoracotomy

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(1) Jour. de Méd. de Bordeaux, Feb. 15, 1919.

should be carried out. The laboratory findings should always be at hand if possible. The hemothorax recurring should be aspirated on the 4th or 5th day.

C. H. Waters[2] gives the details of an interesting *gunshot injury with extrusion of the entire stomach and laceration of the spleen.* It is especially interesting because it occurred in civil life: A boy, of 15, pulled a shot gun toward him with the usual result; with assistance he managed to walk 600 ft. to a house, where he was seen in about 20 min. The entire stomach, much distended, was found extruded through the enormous hole. It occupied much the same position as a football carried in the angle of elbow, and was about size of adult head. The stomach seemed to be intact and was covered with dirt, grass and fragments of clothing—and prevented from retracting by the jagged ends of the ribs. The patient was at once given 0.5 gr. of morphin and transported to the hospital.

The laceration of the diaphragm was linear, 3 in. long, and involved only the muscular portion. Exploration disclosed complete retraction of the lung, a portion of the lower lobe margin shot away, and considerable clotted and fluid blood. The heart, readily palpated, had retracted to right and was lying under the sternum. The chest was carefully cleared of clots, fragments of ribs and clothing, and attention directed to the diaphragmatic rent. Suture had been started at the inner angle, No. 2 chromic gut being used, when considerable blood was observed issuing from abdominal cavity. Investigation revealed the spleen almost completely torn in two and its diaphragmatic surface extensively lacerated as well. An attempt to deliver through the opening failed to offer comfortable access to its pedicle, largely because the costal margin was intact. The suture of diaphragm was hastily completed, and abdomen opened. A quart or more of free blood was found in peritoneal cavity. The spleen was rapidly removed, after double ligation of its pedicle *en masse.* No further injury was noted; the abdomen was then closed. Then arose the problem of closing the thoracic wound, 8 in. long and 2 wide. The 7th, 8th, and 9th ribs having been

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(2) Jour. Amer. Med. Ass'n, Nov. 15, 1919.

shot away, an inch or more of the fragmented ends was removed, thus facilitating closure, but under considerable tension.

Considerable superficial sloughing of the chest wound prolonged its healing. The patient gained rapidly in weight and strength and was back in school in 2½ months. He is now a robust boy and apparently no worse for his experience. In the hope of noting the blood changes from splenectomy, daily counts were made for 2 weeks. A persistent average of 16,000 white cells with a polymorphonuclear percentage of from 80 to 85 was noticed. In the interpretation of the blood changes in this instance, one should consider the probable influence of moderate infection, as the patient was slightly febrile during the observation. Nine months later, examination gave a count of 5,500,000 red cells; the white count was 12,500, and polymorphonuclears, 78%.

In the present and last few Surgery volumes several instances of extraction of missiles from the large vessels and heart have been noticed, but the one of *extraction from the pulmonary artery,* seems to be unique. Ch. Viannay[3] who reports it, states the soldier was wounded in l. side of chest with hemothorax. For 3 weeks operation was refrained from, but the rise of temperature was disquieting, and operation finally determined on. The *x*-ray located the ball 3.2 in. deep, under 4th l. cartilage, moving with cardiac pulsations. After ant. incision, over 500 c.c. of blood were evacuated from pleura, and about 100 from pericardium. However, the ball was not in pericardium, it was felt in root of l. lung, and attempt made to remove it through soft parts with director. Suddenly while trying to pass around a vascular trunk which seemed to interpose between director and the bullet, a furious hemorrhage of dark blood came on; this was found to proceed from pulmonary artery, through the laceration of which the projectile was seen and pressed out with finger. It being impossible to suture the wound, Viannay was obliged to ligate. Pleural cavity mopped out and closed without drainage. Next day the temp. rose to 103.1, in 5 days there was a gangrenous odor to breath, and

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(3) Lyon Chirurg., January-February, 1919.

death with serious symptoms of pulmonary gangrene, followed on 10th day. Necropsy revealed total gangrene of lung and thrombosis of the l. branch of pulmonary artery extending from the r. heart to the ligature, which had been placed close to entrance into hilus.

Abscess of the Lung, with special reference to treatment, is discussed by C. A. Hedblom[4] of the Mayo Clinic. In the previous year 16 patients were operated on, with apparent etiologic factors as follows:

Pneumonia (postoperative)	4
Teeth extraction	3
Tonsillectomy (operation elsewhere under general anesthesia)	2
Gastroenterostomy for ulcer	1
Grippe	1
Trauma (followed by pneumonia)	1
Questionable	4

The characteristic symptoms are more or less those of a systemic infection, with cough and sputum. The most suggestive single symptom is a productive cough. The sputum is usually purulent, foul, and profuse. It may, however, be mucopurulent or watery, and especially if the abscess is small and the communication with a bronchus narrow or absent, the amount be very moderate. In 4 cases the sputum exceeded 8 oz. in 24 hours. In 2 it was over 20 oz. In most the amount was not in itself remarkable. Sudden onset of a large amount of sputum was noted in a case in which the abscess followed teeth extraction under general anesthesia. The odor was offensive in 10 cases, exceedingly so in 2, and practically none in 4. Definite hemoptysis was present in 6. In no instance were tubercle bacilli found in the sputum.

Fever may be remittent, intermittent, or absent. It is usually present at the onset of abscess formation and incident to the retention of pus. It may be absent in the presence of profuse putrid sputum. Polynuclear leukocytosis is the rule, but it was absent in 4 cases. Weakness and marked loss of weight is usual. In 4 cases there was a loss of more than 25 per cent.

The physical signs are variable, owing to the presence of several inconstant factors. Among these are the size

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(4) Minnesota Med., September, 1919.

of cavity, distance from the periphery of lung, amount of surrounding pneumonitis, varying amount of fluid content, presence or absence of obstruction at the mouth of the bronchus draining it, condition of the pleura, presence or absence of pleural effusion, etc. The most characteristic sign in this series was localized dulness over the area involved. The x-ray furnishes the most reliable evidence as to the location and extent of the lesion. Interpreted in the light of the history and other findings it is also probably the best means of diagnosis.

The differential diagnosis of abscess and circumscribed bronchiectasis is often impossible. Chronic pulmonary abscess may lead to secondary bronchiectasis and abscess may arise in the parenchyma from the ulcerating through of a bronchiectatic abscess. The important consideration from the standpoint of treatment of bronchiectasis is the size and number of cavities. A large cavity, or even a number of small ones in a circumscribed area, may be drained with some benefit. Widespread foci, either unilateral or bilateral, will not be benefited by operation. The x-ray is indispensable in such cases. Cases in which the shadow is circumscribed in one lobe are the most difficult to differentiate but these also are most likely to be benefited by operation.

Tuberculous cavitation is always to be differentiated from abscess. A family history, insidious onset and early hemoptysis, are suggestive of tuberculosis. Tuberculous infection is most frequent in the upper lobes, particularly the apices, but abscesses also occur there. Furthermore, typical pyogenic abscess may develop in the presence of a tuberculous lesion. Failure to find the bacilli in a characteristic purulent sputum, and negative x-ray findings, are probably the surest means of excluding tuberculosis. Six patients had fever, hemoptysis, night sweats, and loss of weight. The x-ray showed a tuberculous process in the presence of a typical abscess in 2. One was discharged from military service with a diagnosis of pulmonary tuberculosis. The patient died 10 months later from an intractable gastroenteritis, and necropsy showed no tuberculosis.

An encapsulated or interlobar empyema is probably the most frequent type of a perforating abscess and is also the most difficult to differentiate. In some it is impossible to determine whether the process is primary in the pleural cavity or in the lung. Malignant disease may simulate abscess by a chronic productive cough, fever, leukocytosis, physical signs, and the *x*-ray. In 2 such cases operation was done. One case was not absolutely proved, but the subsequent course gave every indication of malignancy; in the other a bronchiectatic condition was found at operation. Postmortem showed this to have been secondary to primary malignancy.

The aspirating needle in the diagnosis of abscess is decried by most surgeons of experience, if not by all. Even if adhesions prevent infection of the pleura, deep cellulitis of the chest wall may supervene.

Late drainage doubles or trebles the operative mortality and morbidity. A two-stage operation under local anesthesia is relatively safe and satisfactory.

According to N. W. Green[5] the *diagnosis of a lung abscess*, if acute, may be based upon certain factors, a prominent one of which is a fresh rise of temperature. After recession of the temperature come symptoms of increased cough and sputum, and a changing shadow as shown by consecutive *x*-rays. The history is that it follows either the inhalation of a foreign body or a pneumonia. The pathology is that of a lung cavity in one side or the other, or possibly on both sides. The physical signs are those of localized consolidation with occasional cavernous breathing and bubbling râles. Clubbing of the fingers is constant. The expectoration is profuse, of a sweetish, fetid odor, rather free from tenacious mucus and greenish-yellow. The treatment is chiefly surgical, and consists in removal of a rib or ribs, with drainage of the abscess through an adherent area of the visceral to the parietal pleura. There are certain abscesses with thickened walls which may require more extensive surgical treatment. These will probably not be cured by simply draining, may necessitate the resection of a lobe of the lung. The procedure for draining may be of a one- two- or more stage operation. The first stage may be used as an index of the power of resistance. If operative treatment is refused,

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(5) Annals of Surg., November, 1919.

or seems unjustifiable, postural treatment may sometimes effect a marked amelioration.

Resection of the lung *for post-tonsillectomy abscess* was done by H. Lilienthal.[6] A man, of 26, was first seen March 14, 1917. About 15 months before, he had had his tonsils removed in general anesthesia and about a week afterward coughing began with foul expectoration and occasional hemorrhages. For days and even weeks at a time the patient felt fairly well and coughed but little. Then there would be an attack of fever, hemorrhage, emptying of the abscess, and much coughing with the discharge of large quantities of fetid pus. His first hemorrhage occurred about 6 weeks after the onset. At that time his general condition was good and his blood showed 4,300,000 red cells with 9,500 white. Within a few weeks, 15 hemorrhages, some quite copious, occurred. Occasionally there was an attack of ''emptying'' in which as much as a pint of foul pus was coughed up in a few hours. In the beginning, pneumococcus was found in the sputum and autogenous vaccines given with no apparent improvement; indeed, there was some hemoptysis after each injection. *X*-ray on July 17, 1916, resulted in the following findings: In right chest, there was a cavity in the mid-clavicular line; an area of infiltration from 7th to 9th ribs (middle lobe) with a cavity about size of a walnut. Infiltration about 4 in. vertical by 3 in. horizontal. There was much infiltration outside the zone of inflammatory reaction.

Two days after admission, lower middle and part of upper lobe of r. lung removed. In exactly 4 months resumed his occupation. When clothed, his figure looks symmetric but there is considerable contraction of r. chest. The wound remained open for nearly a year longer, then gradually closed, but reopened once or twice, and finally healed soundly. (Plate XII.)

[There seems to be a definite relation between tonsillectomy under general anesthesia and something which occurs to the patient when anesthetized, which does not occur when the operation is performed under local anesthesia. Lung abscess appears quite common in the patients having been operated on under general anesthesia,

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(6) Surg., Gynecol. and Obstet., November, 1919.

while it seems not to occur in those operated on under local anesthesia.—Ed.]

Tumors and Cysts. *A mediastinal dermoid* was removed by I. B. Harris.[7] A woman, of 19, was admitted Feb. 28, 1916. She complained of: Shortness of breath, with a little dyspnea especially after exertion, a cough and some pain in r. side. Suspecting tuberculous empyema Harris proceeded to aspirate the chest. The aspirating needle withdrew a considerable quantity of semifluid yellow material, it would not flow freely and as he withdrew the needle a long hair came out with it. Patient sent back for further investigation.

Her physician had obtained similar material about 3 weeks previous. It was decided a dermoid was present, and operation done March 4. The mass removed was a cyst 8.8 by 7.6 by 4 in., the inner surface was covered with hair and the contents oily lumpy material and a great deal of long brown hair. Three other small dermoids were attached but did not communicate with it. One about the size of a hen's egg communicated with the cavity. The weight was about 2800 gms.

Several secondary operations were necessary for obliteration of the cavity, and she was not discharged till June, 1918.

The *diagnosis of hydatid cysts* may be made sometimes by eosinophilia and by Weinberg's reaction yet in a case seen by A. Faginoli[8] both these signs were lacking, and the diagnosis was uncertain until use of the *x*-ray. A man, aged 20, with history of paludism, was suddenly seized with pain in chest, dyspnea and free hemoptysis. He then improved slowly, but slight dyspnea persisted with expectoration of mucopus, in which no bacilli could be found. Two areas of dulness, hemothorax on r., lessened vesicular murmur. Bronchopneumonia was suspected, also tuberculosis, but the *x*-ray clearly showed three round intrapulmonary shadows moving with respiration. Exploratory puncture low down evacuated a clear fluid, and the eosinophilia suddenly rose from 1.5 to 10%. The diagnosis of hydatid

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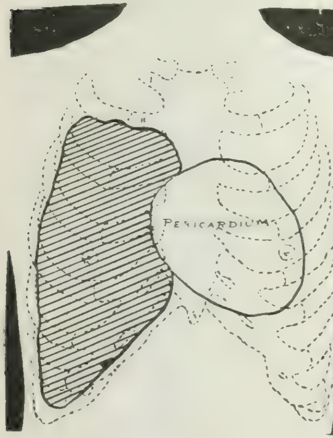
(7) Ohio State Med. Jour., September, 1919.
(8) Riforma Med., June 21, 1919.

cyst (which in the lung is only found in 10 to 15% of the cases), was confirmed by expectoration of the characteristic hooklets. Operation was refused.

An *improved operation for large hydatid cyst of the lung,* was resorted to by C. E. Corlette.[9] The patient, a man, of 36, had an enormous cyst on l. side, it was simple, *i. e.* without daughter-cysts. The fluid, probably amounting to several quarts, was drained out, and then the cavity mopped out till it seemed dry. Here followed the principal feature of the treatment. He stitched up the gaping opening through pleura and capsule with catgut, and then completely closed the wound, without drainage. On examination 4 months later, the lung had expanded down to the level of the incision. There were some slight signs of emphysema, but very good breathing. The patient himself reported that he had never had the slightest discomfort or inconvenience, and had felt perfectly well.



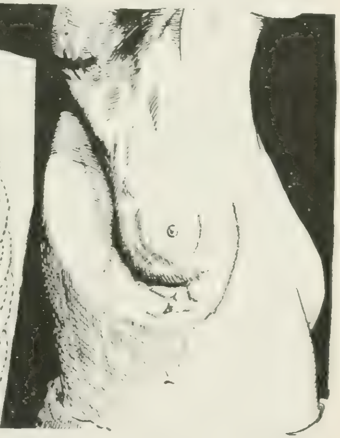


Fig. 101. Diagram showing location of mediastinal dermoid.
Fig. 102. Drawing from photo of patient after healing of wounds (Harris).

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(9) Med. Jour. Australia, March 1, 1919.

The semiprone position, with the side to be opened at the edge of the table and down, while the sound side is up, is not described in the books. Devised for hydatid of the lung and in empyemata, Corlette has tested it well during 3 years, having used it in thoracotomies for both conditions, and also for transpleural attack on a suppurating hydatid of the liver. It is incomparably superior to the position generally adopted, with the diseased side raised and the sound side lower and pressed against the top of table. The sole advantage of the common method is it is easy for the anesthetist and for the operator, however dangerous to the patient. But, provided the operator is seated, his position is extremely convenient for operations on the lower thorax—those most frequently required. And while it offers admirable facilities to the operator, it leaves the sound side free and unencumbered. The diseased side is so placed that the best and quickest drainage is provided as soon as the cavity is opened. In hydatid, the position adopted manifestly diminishes the risk of flooding the bronchial system of the sound lung, and the risk of drowning is reduced to a minimum, while, at the same time, the influence of gravity and the downward rush of water brings the cyst-wall out into the wound and greatly facilitates extraction.

[We have employed this method of placing the patient in empyema operations in a number of cases, and have found it exceedingly valuable. In the case of a child in which both pleural cavities were involved, the method proved especially valuable. The two operations were performed four days apart. The child was left in the prone position for ten days after the second operation.—Ed.]

G. Devé[1] objects strongly to the practice of *irrigating hydatid cysts of the lung* with a solution of formalin which is liable to escape into the bronchi. To avoid the risk of secondary grafting, he advises instead *after evacuation of the cysts,* to mop the walls with gauze wet with a 1- or 2-per cent. solution of formalin, or simple ether.

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(1) Presse Méd., July 31, 1919.

EMPYEMA.

Etiology. An unusual condition—*gonorrheal empyema*—occurred in a girl, of 8, under the care of H. S. Woodbery.[2] Nov. 10, 1917, he operated for a general peritonitis, probably due to a ruptured appendix. Drainage was instituted and the abdomen closed without any further examination of the viscera, as the child was very ill and it was thought best not to prolong the operation. Following the operation the clinical course was that of a general peritonitis. On the 6th day there were signs of a pneumonia or an accumulation of fluid at the base of r. lung posteriorly. On aspiration there was obtained about 2 c.c. of a thick yellow pus. From this finding it was thought the child had a right-sided empyema, a thoracotomy was done. When the chest was first opened no pus could be demonstrated, but when turned flat on her back a few c.c. of pus flowed out. The respiration immediately rose from 30 to 48 and the child died in 12 hours from what seemed to be a respiratory failure. No necropsy.

On 2d day after first operation the child was found to have a profuse, vaginal discharge, and smears made from this showed only the gonococcus, the diagnosis being made from the morphology and staining characteristics. Smears from the pus at aspiration and at second operation showed again the gonococcus. A blood culture on 6th day after first operation, using special media, was negative. An attempt was made to grow the organisms in the pus from chest but failed.

According to F. M. Manson[3] the *total number of empyemata,* recognized by antemortem aspiration and by necropsy from the beginning of the epidemic, at a base hospital Sept. 29, to Dec. 31, 1918, was 150, an incidence of empyema to pneumonia of 1 to 13; inasmuch, however, as all necropsies were discontinued for 11 days during the height of the epidemic, it must be assumed these figures are not sufficiently high.

The average time between the diagnosis of pneumonia and the diagnosis of empyema in the 64 treated cases in the first month of the epidemic was 6 days; the aver-

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(2) Surg., Gynecol. and Obstet., December, 1918.
(3) Amer. Jour. Med. Sci., August, 1919.

age time for the 41 treated cases occurring after the first month was 21 days and the average time for the entire series of 105 treated cases was 11 days. Many of the cases admitted with pneumonia showed pleural effusion present on admission, and the shortest interval after entrance before the recognition was a day.

The treatment of empyema, as a result of experience at this base hospital in the spring epidemic, was based upon two conclusions: (1) to tide the patient, seriously ill with pneumonia and empyema, over his critical period, by one or more aspirations, thereby preserving for him all his remaining respiratory function, by avoiding a pneumothorax and collapse of the lung, also avoiding any shock from the trauma and excitement of an operation for drainage, when he was least able to stand it; (2) to maintain a continuous negative pressure in the pleural cavity while being drained, thus shortening the convalescing period by securing expansion of the lung with a constant, rapid lessening of the empyema cavity.

	Number of cases.	Drained through bronchus.	Subsequent thoracotomy.	Subsequent closed method.	Convalescent.	Still under treatment.	Deaths.	Mortality, per cent.
(*a*) Aspirations only....	35	8	0	0	11	3	21	60
(*b*) Aspiration and 2 per ct. formalin-glycerin	43	4	27	21	8	18	17	42
(*c*) Aspiration with later Brewer tube......	25	3	0	17	7	12	6	24
(*d*) Aspiration with Wilson tube.........	4	0	0	3	1	3	0	0
(*e*) Aspiration with later closed method (Mozingo)	19	2	0	19	6	11	2	10
(*f*) Closed method exclusively (Mozingo).	4	1	0	4	1	4	0	0
(*g*) Total of (*e*) and (*f*)	23	3	0	23	7	15	2	8
(*h*) Total treated by closed (Mozingo) method after aspiration and one of the other methods of thoracotomy...	43	0	0	0	11	30	2	4.6

(By way of explanation it should be noted most all of the entire 105 treated cases had a combination of treatments, and the above table should be interpreted with this in mind.)

Surgical Treatment. Concerning *modern surgical treatment of acute empyema,* L. Freeman[5] remarks the old treatment, established long ago and universally practiced, was to drain every case of infected pleural exudate as soon as infection was established, and in general this worked well. It was right in appropriate cases, but recently we have learned it must not be employed in pneumonia till after this has subsided.

Should our old method of the early operative treatment of empyema be completely discarded, or are there still cases in which it should be employed? The answer is there are many such cases. In fact, we usually should operate early when sure the empyema is primary and that no pneumonia or other complication exists.

In conclusion, would it not simplify the situation if we were to limit the term "empyema" to the existence of actual frank pus in the pleural cavity, as it should be limited, and speak of the more watery serous, sero-fibrinous and sero-fibro-purulent exudations which precede the formation of true pus, as pre-empyemic stages? If we did this we would avoid confusion, and our old rule would still apply—to do an open operation in most cases of true empyema.

Morris and Horsley[6] used *local anesthesia in 150 empyemas,* 85 during the epidemic. A 0.5 per cent. solution of novocain and sterile water, to which adrenalin 1 in 1000 is added in the proportion of three drops to the fluid ounce, and the following technic used:

The patient is placed in position and the skin preparation made. Three in. of the rib over the site of the empyema are accurately outlined with a blue pencil, and the needle thrust perpendicularly through the skin at the posterior end of the marked area, injecting the solution at the same time, until the point touches the rib. The point is then directed down to the lower border and turned into the subcostal groove, and 5 c.c. injected into the intercostal nerve. Without withdrawing the

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(5) Colorado Med., April, 1919.
(6) Lancet, Dec. 12, 1918.

needle the periosteum on the whole outer surface of this section of rib, as far forward as can be reached through puncture, is thoroughly infiltrated, beginning at the posterior end and working forward, paying especial attention to the edges. The intercostal spaces above and below are injected and then the subcutaneous tissues and skin infiltrated. The needle is then withdrawn and inserted through the analgesic skin in the centre of the marked area. and the periosteum, intercostal spaces, and coverings of the rib infiltrated in a similar manner. One more puncture, again through the infiltrated skin, at the forward end of the marked portion of rib and the same process repeated will complete the infiltration. Should sufficiently long needles be used the whole area can be covered by two infiltrations, one at each end.

They find to ensure the best results some 20 c.c. must be injected at each of the three punctures, and in stout patients larger quantities will be necessary. If the vertical incision rather than that along the rib should be preferred, carry out the same infiltration, but extend the injection through the second puncture into the skin and subcutaneous tissues well over the intercostal spaces above and below. The infiltration is easy to carry out and only takes a few min.; the patient feels only the one prick of the needle. The operation can be started immediately it is finished. It is necessary to emphasise the importance of using the rib shears with the utmost care, as any wrenching will give rise to pain at the costo-sternal junction. On opening the pleural cavity there may be some discomfort, especially on coughing, sometimes the case in large empyemas.

In nearly all of the 85 cases operated upon since May the patients were suffering not only from empyema but had signs of active pneumonia in both lungs, and many had a blood pressure of well below 100 mm. Hg. Notwithstanding their serious condition no patients were lost at the operation nor did their behavior during it give rise to further anxiety.

Operation for purulent pleuritis *with the patient seated* is praised by P. de la Villéon.[8] To avoid the tendency to asphyxia he has the patient straddle a

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(8) Presse Méd., Oct. 11, 1919.

chair, the head leaning forward supported on the crossed arms. The surgeon stands behind, and in order the field at the lowest part of thorax will be accessible, the patient and chair are put on a platform about 12 in. high. All the maneuvres can now be carried out readily, the rate of evacuation of the fluid regulated at will, as this position assists complete expulsion as well as all false membranes the latter process facilitated by efforts at coughing. If the radiograms are to be used for assistance in the localization, this seated posture is the only one of any real value.

In the discussion, Giordano (Venice) and Auvray (Paris) said the recommendation was not novel. The former has for a long time been in the habit of operating on emphysema in this position, and thought other surgeons had done likewise.

Decortication of the lung for pleuritis was devised by E. Delorme long ago (1893). In a late article he[9] refers to its use after war wounds, based principally on Duvergey's experience in 31 cases, with but 1 death. He believes decortication is the choice in chronic empyemas with total, large or medium-sized cavities. Its value in traumatic pleuritis following war wounds has been proved. It is never serious, and numbers many gratifying successes in young, resistant subjects not weakened by suppuration, given a cavity disinfected as a preliminary as much as possible, and provided the men have no affection of the lungs themselves, the kidneys or liver. It promises the same success in chronic pleuritis following influenza epidemics. The indication as to time is clearcut—it should be done as soon as the lung shows itself incapable of overcoming the resistance of its tight capsule. Radiograms, especially, furnish the means of recognizing a definitive fixation. In timely interventions, this decortication is—in most instances—easy and results in immediate expansion of the lung.

Carrel-Dakin Method. After use in 70 cases at a camp, J. M. Henderson[1] found *the Carrel-Dakin method* is most valuable. The best results were obtained in acute cases, where costectomy was performed, and when

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(9) Bull. Acad. de Méd., Nov. 5, 1918.
(1) Northwest Med., June, 1919.

a limiting membrane had formed, and an opening made sufficiently large to allow the introduction of 4 to 8 Carrel tubes. The average acute cases can be sterilized in 6 to 10 days and the wound successfully closed by sutures or simply allowed to close spontaneously. From the beginning there is a complete absence of odor, the pus disappearing very rapidly and the general condition showing marked improvement.

The treatment of the delayed cases consisted of opening the pockets when possible, or enlarging the sinus sufficiently to introduce tubes, followed by the complete or partial sterilization of the cavity or old sinus with Dakin's solution, and finally introduction of bismuth paste. The treatment of the large pneumothoraces consisted in sterilization of the cavities with Dakin's solution, and the subsequent sealing of the wounds. The first object to be attained is the sterilization of the cavity, considering there is more to fear from the toxemia than from the pneumothorax. It is impossible to lay down any fixed rule applicable to all cases, but each must be considered a problem by itself and the treatment modified accordingly which calls for considerable experience.

One a. m. they found almost every patient complaining of irritation which was evidenced by the redness around the wound. On titration of the solution used, it was found to be considerably above 0.5. On another occasion they found all the wounds dirty, and the "counts" increased, and on titration the solution found below 0.4. This is rather significant and emphasizes the necessity for great care in the preparation of the solution. It was not found practicable to follow the Carrel-Dakin method in every instance, as where a thorocotomy had been performed or in old cases where the opening had become very small, it was impossible to introduce more than one conducting tube and even then there would be no discharge around the tube.

F. C. Paffard[2] treated 12 empyemas *by the open method.* There were 6 males, 6 females and ages ranged from 4 to 37 (5 under 16). In 11 it was secondary to influenza or pneumonia, or both. The time from onset of primary disease and operation was from 2 to 16 weeks,

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(2) Long Island Med. Jour., September, 1919.

in half was 4 weeks. R. side affected in 7; l. in 5. In 2 physical signs as well as *x*-ray plates indicated fluid on both sides, yet on paracentesis but one side was affected. The treatment with Dakin's fluid was successful in 10, one died within 6 days of acute pneumothorax; another within 10 days of pulmonary gangrene.

Complications and Recurrence. H. M. Thomas, Jr.,[3] places on record 2 *ruptures of encapsulated empyema into the pleura.* Both were in army camps, following the epidemic; one was fatal in 13 hours, one recovered after operation, though in desperate condition.

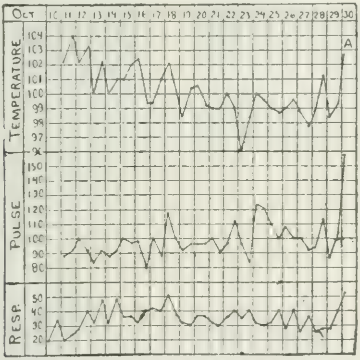

Fig. 103. Curves showing improvement until rupture of the encapsulated empyema. *A*, death (Thomas).

During a more or less normal convalescence, the patient feels a sudden, sharp pain in some part of the chest, brought on by a slight exertion. In a few hours he becomes critically ill; temperature rises sharply to from 102 to 104; pulse is rapid and thready; respirations between 50 and 60, shallow and extremely painful. The eyes are bright, cheeks flushed, and expression anxious. Mentally the patient is alert and fully aware of his critical condition. The pain is localized in the lower chest or entirely in abdomen. On examination, the abdomen is found to be greatly distended, marked tympany extending well up over liver, and the

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(3) Jour. Amer. Med. Ass'n, Jan. 4, 1919.

tenderness, which is general, may be more marked on one side. The chest findings are not striking, but may show a small amount of fluid at one base. The white count reveals an extraordinary polymorphonuclear leukocytosis. The condition becomes progressively worse, with no change in the picture except for increasing prominence of the signs of fluid in chest.

The prominence of the abdominal symptoms and the extreme prostration of the patient led in the first case to a faulty diagnosis. In retrospect, however, they were impressed by the absence of vomiting, which would have been expected in a case of general peritonitis. What occurred, then, was the rupture of a small encapsulated empyema and the quick spread of pus over a large area of the pleural surfaces. As the pleura reacted, a rapid accumulation of fluid took place in the cavity, pushing the lung up and tugging on the adhesions which, in the first case, bound the lung tightly to the diaphragm. The toxemia, owing to the rapid absorption of pus from a serous membrane rich in lymphatics, produced the remarkable reaction that caused sudden collapse. The meteorism and leukocytosis were indexes of the severity of the reaction. The pleuritic pain, coupled with the abdominal distension, explains, though somewhat inadequately, the extraordinary dysp-

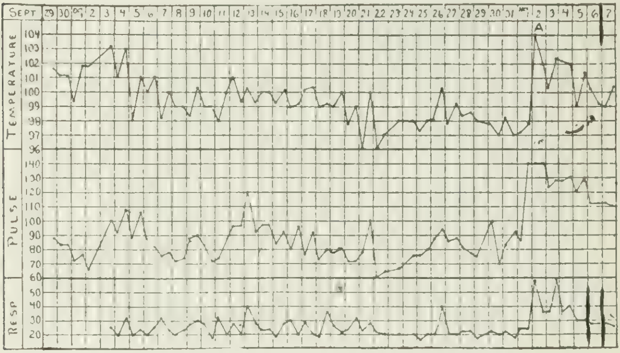
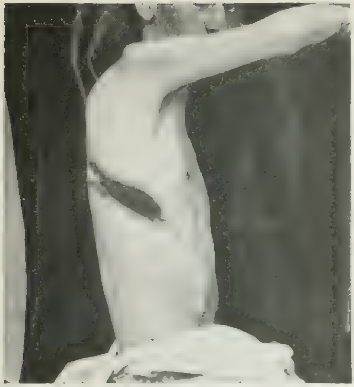
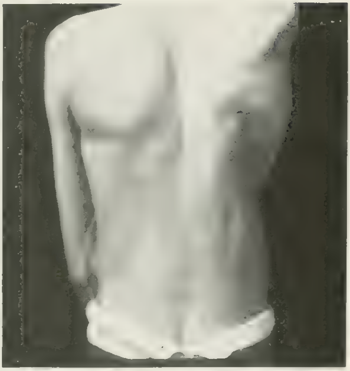


Fig. 104. Curves showing improvement until rupture of empyema and course after thoracotomy. *A*, operation (Thomas).

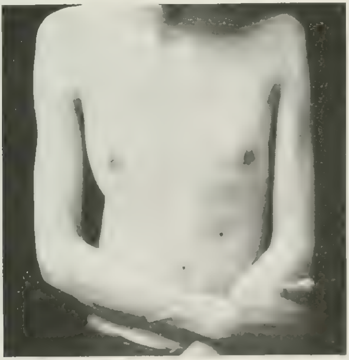
PLATE XII.



Patient up and about a few weeks after operation. With retractor in wound all parts of chest could be easily observed.



Wound entirely healed when patient was exhibited. Note function of right arm.



Front view, comparatively little asymmetry. Lilienthal. (See p. 309.)

nea. Satisfactory treatment depends on its early recognition and free drainage of the pleural cavity, thoracotomy being the choice.

One of the *frequent causes of delayed healing of empyema cases* is the failure to have the patient carry out suitable lung exercises. The reason for this neglect seems to be due to the fact that the method of blowing water from one bottle to another, and other similar procedures have not proved satisfactory. For some time, C. Smith[4] been instructing empyema patients to blow up an old inner auto tube from which the valve has been removed. This exercise should be done several times daily after the acute symptoms have passed. This method gives better results than any other mechanical procedure and he is sure it has hastened the cure.

[See also New Instruments.—Ed.]

F. A. Stevens[5] treats of *recurrences after operations for empyema.* Some 123 cases studied at an army camp naturally fall into groups: Group 1 of 100 cases which had been treated by simple drainage immediately following diagnosis, and includes the cases up to April 15, 1918. Fifty-six patients were healed under this treatment; the empyema in the remaining 44 became obstinately and persistently chronic until treated by the Carrel-Dakin method. In only 10 was a thoracoplasty of moderate extent finally indicated. In Group 2 there were 23 patients who were admitted during April and May. They were treated by preliminary aspiration until the primary infection of the lung had subsided, and subsequently by thoracotomy and Carrel-Dakin.

Among the cases healed under simple drainage, 14 of the recurrences were encountered within eight months after the primary healing. The majority were discovered during the first or second months, either during routine examination or because of a rise of temperature. Ten cases, occurring at the site of primary operation, were caused by the hemolytic streptococcus, the cause of the original infection. The pus collections in the remaining 4 were found either at the apex of pleural cavity or very high in axilla, and probably were the

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(4) Surg., Gynecol. and Obstet., July, 1919.
(5) Jour. Amer. Med. Ass'n, Sept. 13, 1919.

result of isolation of a part of the original cavity by adhesions soon after operation. Although they were all purulent, living streptococci were found in only 2; the others were sterile.

Among the 67 healed under the Carrel-Dakin treatment, comprising the refractory empyemas of the earliest group as well as those in which surgical solution of chlorinated soda had been used throughout, there were 8 recurrences. Three of these occurred at the site of the previous operation: were due to the hemolytic streptococcus, while the third was merely a collection of a small amount of clear, sterile fluid. Except for a long abscess found at the angle of the scapula, the remaining 5 recurrences were at the apex of the pleural cavity. Bacteriologic examination revealed streptococci in 2 cases, *S. aureus* in 2 cases, and one was found to be sterile pus. A study of these recurrences is an interesting demonstration of the efficacy of the Carrel-Dakin treatment. The group treated by this method not only shows more perfect results, but also the pus pockets which were discovered were usually at some distance from the original focus.

In discovering these secondary foci of pus there were two symptoms which proved of the greatest value: 1. The patients either never regained their normal weight or even lost in spite of the fact they were continuously kept on high carbohydrate diet. It is interesting to note that in the cases of recurrence in 2 patients whose weight was above that recorded on admission to the army, the fluid was sterile. 2. In all recurrences of a purulent nature, the pulse was always rapid and there was also a moderate fever. Fever of a very acute nature was found most frequently in cases which had been allowed to close before complete sterility was obtained; in these the febrile reaction was sharp and was usually accompanied by constitutional symptoms. In other cases a mild evening temperature of 99 to 99.5 F. was observed, especially when the pus pocket was at some distance from the primary empyema and evidently of long standing.

An example of *bilateral empyema* was treated by L. Norrlin.[6] A child, of 8, while convalescing from influen-

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(6) Acta Chirurg. Scand. (quoted in Jour. Amer. Med. Ass'n, Nov. 15, 1919).

zal pneumonia had about 150 gm. aspirated from each side. Relief only transient until a full half-liter was evacuated from l. side, and over half as much on r. Among 588 cases of empyema in the hospitals of Sweden, it was bilateral in 5 and only one of these survived. He cites 117 bilateral cases from the literature; the mortality was 37%, but only 10 with operative treatment in time. It is evident that primary thoracotomy gives better results than simple aspiration. But it may be wiser to leave an interval between the interventions, even when the empyemas are simultaneous. In his own case simple pleurotomy alone answered every purpose.

THE PERICARDIUM AND HEART.

Pericardium. The *surgery of the pericardium* is taken up by J. W. Little.[7] The pleural cavities virtually meet in the midline, except for a small triangular space behind the lower end of the sternum and the 6th and 7th cartilages. This has been called the "triangle of safety," for, within this area, the pericardium may be opened without opening the pleura. The long axis of this space is about .6 in. to the l. of the midline of sternum, and parallel to a line running vertically through the l. costosternal articulation. At about the middle of this triangular space is the junction of the 6th l. space, and border of sternum, and at this point a needle directed straight in would enter the ant. costophrenic pouch.

The wisdom of tapping with a needle or trocar has been the subject of much controversy. The position of the heart immediately behind wall has made it necessary to choose between the danger of wounding it and of piercing the pleura. Some surgeons consider the latter as the lesser evil, and advocate puncture laterally outside the triangle of safety, but beyond the probable location of the border of the heart. The danger of this is obvious in case the fluid in the pericardium should prove to be purulent, and, therefore, an operation that opens the pleura must be condemned. The use of a large needle or trocar has caused disastrous results and should be

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(7) Journal-Lancet, June 15, 1919.

abandoned. In fact some surgeons have concluded open operation alone is permissible.

However, at present a capillary trocar for diagnosis or treatment may in some instances be justified. Some of the reasons are the following: Large accumulations of fluid are not likely in extensive pericardial adhesions; and it is these cases in which the heart is most certain to be injured. Improvements in diagnosis, especially the x-rays, enable us to determine more accurately the position of the heart and the distribution of the effusion. Cases occurring in rheumatism or dropsy are almost always aseptic, and may be cured by aspiration. The operation is simple, and can be borne by a patient who is in no condition for a more extensive operation. The operation is simple enough to be used in an emergency when the facilities for a formal operation may not be at hand. If a capillary trocar is to be used, it may be introduced in the 6th space close to the sternum, at which point it should enter the anterior costophrenic pouch. It may also be introduced in the l. costoxiphoid angle, and pushed forward until it pierces the diaphragm and then in. The trocar should be withdrawn if it fails to strike fluid at a depth of 1 in. In that case the attempt should be abandoned, and open operation performed.

The same anatomic considerations hold good in open operations as in paracentesis. It is of great importance to avoid injuring the pleura, and, if this accident should happen, the wound should be closed by suture or ligature. In the Kocher operation an incision is made over the 6th cartilage, which is then resected. The int. mammary vessels, when encountered, are ligated and divided. The dissection is continued down to the pericardium, which can be recognized as a dense, glistening layer. Care is taken to avoid injuring the pleura by retracting it towards the left, if necessary. A small opening is made and the fluid permitted to escape slowly. Irrigation is of doubtful value, but has been advocated. A soft rubber tube is inserted into the bottom of the cavity, and the pericardium sutured to the skin to prevent infection of the mediastinum. Another method of approach, which is anatomically correct, is by an incision along the lower margin of 7th l. cartilage and across the base of ensiform. Divide the cartilage, and pass the finger beneath the sternum, between the triangularis sterni muscle and the diaphragm. Remove 7th cartilage and part of the sternum. The 6th may also be removed if necessary.

All cases containing pus in the pericardium require immediate operation, and any case with fluid may, at any time, become an emergency case, especially if it accumulates rapidly. It has been observed experimentally that the heart will tolerate fluid in the pericardium up to a certain point, but beyond that the addition of a few c. c. will seriously embarrass the heart, and may even prevent the auricles from filling, and thus stop the circulation altogether, producing "cardiac tamponade."

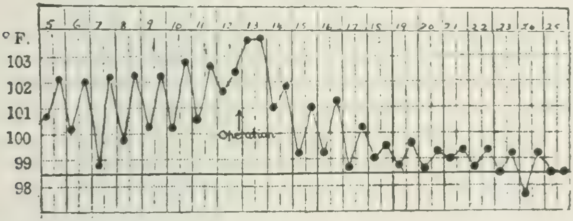

Fig. 105. Temperature before and after pericardiotomy (Noble-Vine).

A note on *a case of pericardiotomy* is contributed by Noble and Vine.[8] The successful operation was done on 12th day after a rifle bullet had passed through l. chest anteroposteriorly. After 12 oz. of sterile fluid had been withdrawn from pleura, the pericardium was incised, when considerable cloudy fluid escaped, this was found to contain a short streptococcus. Wound closed with drainage. Two days later: Breathing and cough much easier; drains removed. Pulse and temperature now gradually fell and the wound healed by first intention. Four weeks later he was evacuated to England. The cough and dyspnea had disappeared, the cardiac dulness much less, and there was no friction. Subsequent inquiry 2 months later showed improvement was maintained.

R. S. Skirving[9] removed a piece of shrapnel casing

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(8) Lancet, Jan. 18, 1919.
(9) Med. Jour. Australia, Aug. 23, 1919.

from the pericardium successfully. The wound was in October, 1915, and operation following February. On opening sac it was full of soft, bloodstained adhesions. The foreign body was at base behind, and about ⅔ extra-pericardial. In bed 42 days, mostly semi-recumbent. P. over 100 at operation, dropped to 80 by 10th day.

Heart. The *new orientation of cardiac surgery* is considered by H. Vaquez,[1] the internist. Operations destined to remedy defective function of the heart can be divided into 2 groups—extra- and intra-cardiac.

The former were introduced by Delorme, who suggested treating symphysis of pericardium by destroying the adhesions. Brauer's viewpoint was different: Starting with the generally-admitted conception that in such symphysis the cardiac fatigue is due to the traction exerted on the organs in the vicinity, he thought it would suffice to divide the costal cartilages and ribs, thus mobilizing the sternocostal wall. Delbet and Douay, however, showed this view was erroneous, and that cardiac insufficiency results from the impossibility of the pulmonary tongues fixed by adhesions, from distending at the moment of systolic retreat of the heart, and fill up the virtual cavity thus created. Thus the good results from Brauer's operation are explained by the fact the sternocostal wall is mobilized and assumes the rôle normally taken by the tongues of pulmonary tissue, thus permitting the heart to contract on itself completely.

This view led Delbet to perform the same operation where the cardiac activity was impeded by other causes than pericardial adhesions, though with analogous consequences, *e. g.*, extensive pleural adhesions, pulmonary sclerosis, etc., which also often set up permanent dilatation, especially of r. side of heart. Under such conditions mobilization of the sternocostal wall should cause the dilatation to subside. This was proved by successful cases, and a few years ago Vaquez at a meeting of the Academy showed a man with bilateral pleural symphysis, due to recurrent pleuritis, in whom grave symptoms of cardiac insufficiency were stopped by such intervention. At the time of report, 7 years after, the man was in good condition and able to undertake hard labor.

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(1) Bull. Acad. de Méd., Oct. 7, 1919.

On the other hand, operations on the heart itself—preventive or curative—have for their object, to put the heart in the way to normal action by remedying a lesion already present. Over 20 years ago, Lauder Brunton having in mind certain lesions, such as mitral stenosis, which progress inevitably to a fatal issue, asked if these could not be helped by surgery. He even undertook some animal work. Of late years this question has been revived by Jeger, Carrel and others. Tuffier had distinguished the zones of danger in the heart from those accessible. Also the possibility of intervention; as to the basis and the methods to be employed, these can be determined only by collaboration of surgeon and physician. To the latter falls the duty of settling the mechanism of these valvular lesions, and to select those in which operation seems indicated. It does not seem the last will include the insufficiencies, those of the auriculoventricular openings are due less to loss of substance of the valves proper than to retraction of their pillars, and it is not clear how this could be helped by the knife. As to arterial insufficiencies, either they are isolated and then not very serious, or they are associated with alterations of the vessels generally, and do not call for operation.

Stenosis of the various orifices is the principal indication for intracardiac operations. But the diagnosis alone is not enough, we must know the degree as well. Slight aortic or mitral stenosis does not present much gravity. With a tight stenosis the situation is entirely different, in the aorta there will be considerable hypertrophy of the l. heart and in mitral lesions excessive dilatation of the auricle. The prognosis is then most serious, no matter what the apparent state of the patient. A few years since Vaquez referred to Tuffier, a young man with mitral stenosis which had caused such increase in the lesser circulation that the 2d sound over the pulmonary orifice was heard at some distance. They dared not operate. Shortly after the man had multiple pulmonary infarcts with free hemoptysis which rapidly proved fatal. In a similar case operation would be justified, provided there was some chance of success, but in what manner?

As far as arterial stenoses are concerned, we may hope for a resection of the sigmoid valves, which is feasible and profitable—always provided the stenosis is not due to changes in the vessel. The special makeup of mitral stenosis, the predominating rôle of the retraction of the pillars which brings the infundibulum into the interior of the ventricular cavity, all show there is but little to be expected from direct attack on the walls of the orifice. We must, then, find some other means (or maybe several) allowing the blood freer ingress to the ventricle, because the obstacle to this is the cause of all the trouble. On this aspect the physician may merely express his preference, the surgeon himself must choose the operation.

An encouraging feature is that of late years the technic has made notable progress. Nowadays the useful means of access, those which are forbidden, and the method of suspending the circulation long enough for the time necessary. On the other hand the experience gained in the War has completed our knowledge on suture of the heart and vessels. Many cases have occurred which should be analyzed, not on account of the surgical prowess they bear witness to, but because of the greater or less tolerance to trauma of different portions of the organ. By adding these to other facts which result from animal experiments patiently carried out, we should be in sight of the day when surgeons who do not undertake such interventions will be condemned as not having done all their duty.

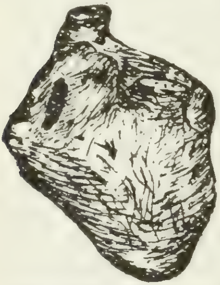
Fig. 106. Rupture of heart, without external lesions (Bilderbeck).

Heart Wounds. An interesting case came under the notice of A. C. L. Bilderbeck[2]—*traumatic rupture of heart, without fracture or external lesions.* A soldier, aged 19, during fire practice was crushed between the handle bars of the fire pump and a stone wall, dying immediately. Necropsy showed heart very small. The valves and muscle were apparently natural, and there was no trace of aneurism or old disease. In the r. auricle, between the coronary artery and the entry of the v. cava,

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(2) British Med. Jour., May 31, 1919.

was a small rent measuring about ¾ by ½ in. The only explanation to be offered is at the moment of impact the man may have taken a deep inspiration, engorging the auricle, which then burst on sudden compression through the costal wall.

F. C. Pybus[3] saw a man, of 28, *who was stabbed* in the neck and back and 4 times in thorax. Pneumothorax was produced on each side. Three of the thoracic wounds were over the heart; one of these produced pneumothorax, opened the pericardium, and penetrated l. ventricle, which was sutured about 2 hours later. Nevertheless the patient survived for 5 days, then dying from septic infection of the pleuræ and pericardium.

Successful suture of a stab-wound is recorded by E. F. Butler.[4] A man, aged 42, was admitted soon after injury, but bleeding having ceased operation was not done for 4½ hours. Lung not wounded, hole in pericardium .4 in. long, and one of similar size in l. ventricle.

Bullet Wounds. The *operative indications in intracardiac projectiles* are considered by P. Scalone,[5] based on clinical and experimental investigations. His interest was aroused by caring for a patient who had a bullet imbedded in the wall of r. ventricle, and—apart from slight dyspnea at times—was well-borne. The weapon was fired close at hand and the entrance was through the sternum, it must have involved the heart during systole.

He then undertook some experimental work on the animal heart, very tall dogs were selected to have the organ as large as possible: Incisions with bistoury were made and sutured at once, he also destroyed some tissue with the thermocautery. In both instances the cicatrix was fibrous, there was no regeneration of the muscle but changes extending deeply into the cardiac tissue in the vicinity of the wound; especially after the thermocautery, where the effects of heat seemed to be added to the operative trauma. These latter lesions, he believes, must closely resemble the effects from a projectile embedded.

As regards the indications for operation, taking into consideration the dangers attending such wounds

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(3) Lancet, June 14, 1919.

(4) Jour. Amer. Med. Ass'n, May 3, 1919.

(5) Il Policlinico, Feb. 15, 1919.

(changes in the walls, the septum, fibrinous emboli, etc.) as well as the difficulties of intervention, Scalone concludes there are 2 different classes, according to whether the projectile is embedded or free in the cavities. When fixed in the wall abstain in practically every case, for extraction is liable to weaken the wall and does not inevitably put an end to the functional disturbances, which are often due to some deep change in the wall. The only indication is where there are disorders of the intracardiac nervous system, caused by irritation. Where the projectile is free, on the contrary, the indication is for operation nearly always, in spite of the much greater gravity. This indication is based, on one hand on the dangers of embolism, and on the other hand, of capability of producing a clean-cut wound which will after suture leave a solid wall.

R. de J. de Jong[6] gives details of a case of bullet wound of the heart *without opening pericardium.* The missile had grooved the outer layer of pericardium only, but the intact inner layer was carried in and the distended ventricle ruptured by the shock. While fatal he was able to find 16 similar ones, some of which recovered.

Migration of Missiles. Sir J. Bland-Sutton[7] in his lecture on "*missiles as emboli,*" details several interesting cases:

I. A man, of 23, died after multiple wounds, arm, chest, and knee. There was a hole in r. chest, r. leaf of diaphragm and in cava 1 in. below entrance of hepatic vein. A flat piece of shrapnel, .8 in. square and .5 thick, lay in r. ventricle. No wound of heart, the fragment after piercing the diaphragm entered the cava and was carried to heart. Nothing in the history suggested the object hampered the cardiac action, death was due to severe streptococcal infection.

II. A German bullet entered the l. ext. iliac and penetrated adjacent vein, carried thence to heart. It was ejected from the ventricle and plugged the l. pulmonary artery. All these extraordinary sequences, including leg-amputation, were survived for 12 days.

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(6) Tijd. v. Geneesk. (quoted in Jour. Amer. Med. Ass'n, April 19, 1919).

(7) Lancet, May 10, 1919.

III. Missile entering artery and behaving as embolus without entering heart: A soldier was wounded in chest with a bullet. Surgeon evacuated 4 pints of blood and sewed up wound. Streptococci were obtained in culture from the effused blood and man died on 5th day. Before he died, a bullet could be felt in the l. ext. iliac. After death a small wound was found in aorta just below arch; the entry and the bullet was driven as an embolus along into the iliac. Each end of bullet embedded in firm clot.

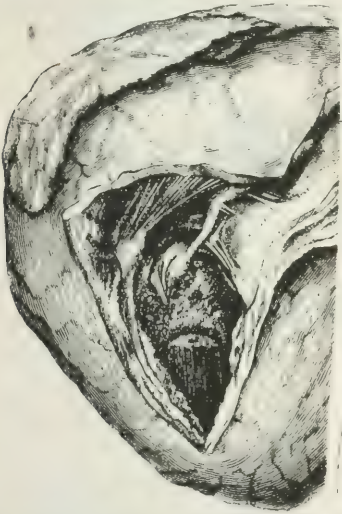

Fig. 107. Right ventricle with a piece of shrapnel which arrived as an embolus.

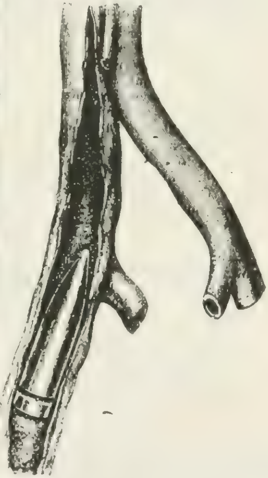

Fig. 108. Embolic bullet lodged in external iliac artery; it entered the thoracic aorta (Bland-Sutton).

IV. Penetrating bullet wounds of aorta are not always fatal: A man, aged 32, attempted suicide. The bullet entered the l. chest near 7th rib. After injury there was no disturbance of heart's action, and a radioscopic examination failed to furnish evidence of the bullet; the man recovered completely. Thirteen months later he was killed at work by an electric current. An 8 mm. bullet was found in aortic sinus. Just above the valve there was a scar in the aorta where the bullet had pierced it. The bullet was attached to the wall by a slender pedicle.

M. Perdoux gives[8] an account of *a remarkable case*, which forms a fitting accompaniment to those of Bland-Sutton, and happily recovered. A soldier, after being wounded in the chest, had no symptom of a cardiac lesion, yet the *x*-ray revealed the missile in the ant. wall. Expectancy was decided on. Exactly a month after injury, a new fluoroscopic examination showed the bullet was in r. common iliac at its bifurcation. None of the customary symptoms of occlusion of a large artery by clot were present, neither sudden acute pain, circulatory disturbances, paralytic nor trophic changes; the only thing was total absence of femoral pulse on same side. Operation was not determined on for 2 months, then, fearing secondary ulceration of the arterial coats, the vessel was exposed through a laparotomy incision. After extraction of the missile the hypogastric resumed its pulsations, but the femoral pulse remained imperceptible, the ext. iliac seeming to be closed below the point of suture by endarteritis. At the time of report (3 months still later) there was no circulatory disturbance despite the complete absence of the femoral pulse; locomotion was easy and painless; nothing on part of heart.

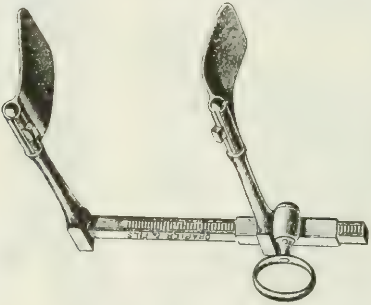

Fig. 109. Retractor with interchangeable blades (Jayle).

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(8) Presse Méd., April 17, 1919.

ABDOMINAL SURGERY—GENERAL.

Several instruments for abdominal surgery are described by F. Jayle:[9]

(*A*) *Retractor with interchangeable blades*, which by the way is very similar to Balfour's (1913 volume, p. 362). However, Jayle's is a modification of a model devised in 1907, principally by addition of the changeable blades. The blades are straight, somewhat curved at slot, and flaring slightly at free ends. two lengths, 2.4 and 1.6 in.

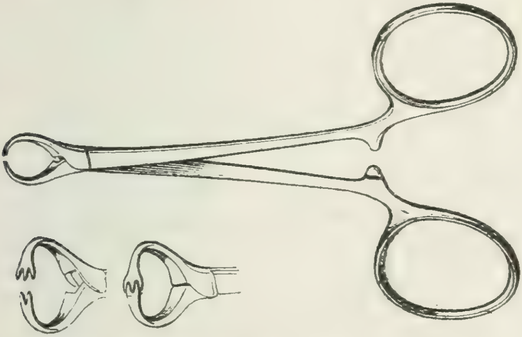

Fig. 110. Lobster-claw forceps (Jayle).

(*B*) *Lobster-claw forceps*, 4.4 in. long, one jaw has 2 teeth, the other 3, these teeth are very slender. Used for clamping sponges or towels about field, as retractor for edges of wound, to hold them together while clips are applied, etc. These forceps afford a firm grasp and do no damage, owing to the slender teeth. The shape enables a good bite to be had.

(*C*) *Clamp-forceps*, this is strong and never becomes loose. It is straight or right-angled. The former has a plain handle, and opens when pressed on, the other has rings. The strong jaws have deep grooves running along the length.

(*D*) *Weighted retractor*. The ordinary abdominal retractor bent at right angle, with the handle weighted so it will stay in place.

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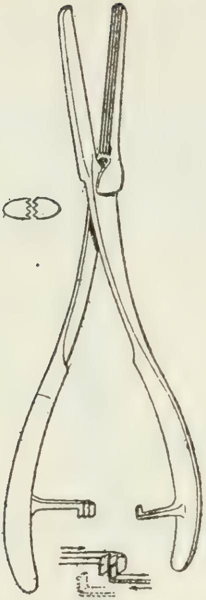
(9) Presse Méd., March 10, 1919.



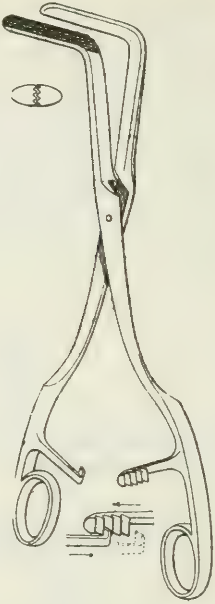


Fig. 111. Straight clamp-forceps.
Fig. 112. Right-angled clamp-forceps (Jayle).

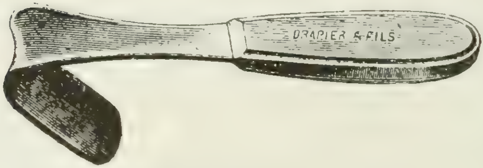


Fig. 113. Weighted retractor (Jayle).

Diagnosis. D. Ligat[1] dwells on the *surgical value of certain abdominal reflexes.* Lennander has shown the viscera are entirely devoid of sensation, that everything beneath the subserosa, including the deeper layer of the parietal peritoneum is insensitive to touch or pain. Yet it is a commonplace that a viscus can, and may, give rise to very severe pain. Moreover, Mackenzie has pointed out that pain is the only sensory reflex evoked in visceral disease. It follows, therefore, that all pain, except that caused by peritonitis, that a patient complains of, or tenderness that an observer may elicit, is due to a true viscero-sensory reflex, and not in any way to pain or tenderness felt in the viscus itself. This cannot be too clearly appreciated.

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[1] Lancet, May 3, 1919.

The clinical method follows: The patient lies on back, mouth slightly open, and arms by sides, and the test should immediately follow inspection. (1) The wall should be pinched with definite pressure at a point where a normal response is practically always met with—*e. g.*, l. hypochondriac region, the facial expression being closely watched at the same time, as the normal response to pinch varies widely in different individuals. (3) An exactly similar pinch is to be applied at those spots which experience has shown to be hyperalgesic and to yield the maximum response when various organs are diseased. No downward pressure is made on the wall, but the skin and subcutaneous tissue are picked up from the deeper layers. (3) The direction and limitation of the spread of the hyperalgesia must be carefully tested. When a single organ is affected careful examination will show: 1. One maximum point. 2. Spread from this in a vertical direction, the hyperalgesia almost always extending further in a downward than in an upward direction. 3. No hyperalgesic spread in a lateral direction.

This method of examination separates the abdominal organs for clinical purposes into two sets: Lateral: Gall-bladder, appendix, tube. Central: Stomach, duodenum, small and great gut. (The diagram shows the areas of hyperalgesia for the organs mentioned.) Points to be noted in connection with the diagram are: 1. The maximum point of each organ or segment of intestinal canal is constant in position, whichever part of the organ or whichever part of the segment of gut is affected. 2. When spread occurs it is invariably vertical in direction, there is no lateral spread. 3. It follows from (2) that when two adjacent organs, such as gall-bladder and stomach, simultaneously produce hyperalgesic areas one can always demonstrate an intervening neutral area of abdominal wall between the areas which have been rendered hyperalgesic. 4. That vertical overlapping of hyperalgesia may occur. 5. That lateral overlap of hyperalgesia does not occur.

While the hyperalgesic area found in a typical case accurately indicates the organ at fault, it in no way helps to determine the position of that organ in the abdominal cavity. It has been Ligat's experience that the organ in which drainage is most easily upset is the one which most readily produces a hyperalgesic area, since it is a truism that obstructed drainage aggravates infection in general.

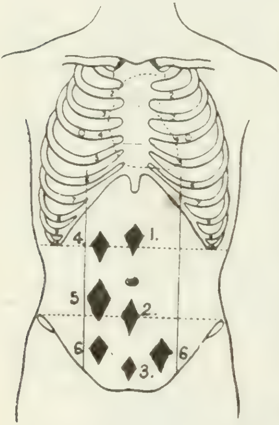

Fig. 114. Areas hyperalgesia is elicited when present. The width of the shaded area does not denote lateral spread, but merely represents degree of intensity of reflex in typical cases. 1. Gastric and duodenal area: maximum point midway between ensiform and umbilicus. 2. Small gut area: maximum point at junction of upper and adjacent fourths of a line from umbilicus to symphysis. 3. Great gut area: maximum point at junction of lowest and adjacent fourths of a line from symphysis to umbilicus. 4. Gall-bladder area: maximum point where a horizontal line drawn from tip of 10th rib crosses a vertical line drawn midway between the nipple line and middle line of abdomen. 5. Appendix area: maximum point at junction of inner and middle thirds of a line from a. s. spine to umbilicus. 6. Fallopian tube area: maximum point at junction of lowest and adjacent fourths of a line from middle of Poupart's ligament to umbilicus (Ligat).

There are only two real fallacies possible, but they must ever be kept in view: 1. A diseased viscus may give rise to no reflex. 2. Two distinct intra-abdominal lesions may coexist—*i. e.*, a chronic appendix and a growth of the pelvic colon—and the appendix may well produce a reflex and the colonic growth none. This only emphasizes the fact that examination of the abdominal reflexes is only a part, although an important part, of a general clinical examination.

Changes in the Organs which have Produced an Abnormal Viscero Sensory Reflex. 1. *Gall-bladder lesions.*—(*a*) Acute cholecystitis; (*b*) gall-stones; (*c*) chronic cholecystitis; (*d*) introduction of peroxid into gall-bladder through a sinus. (The peroxid evidently produced spasm of the gall-bladder, as the patient immediately had a seizure in every way similar to biliary colic. During the attack he had a sharp gall-bladder reflex; this persisted, diminishing in intensity, for 3 days); (*e*) ulceration of the mucosa of the gall-bladder; (*f*) empyema. 2. *Appendix lesions.*—(*a*) Acute appendicitis; (*b*) chronic; (*c*) perforated appendices; (*d*) gangrenous; (*e*) foreign bodies; (*f*) kinked adherent appendices. 3. *Fallopian tube lesions.*—(*a*) Torsion in ovarian cysts; (*b*) acute and chronic salpingitis; (*c*) some cases of ectopic pregnancy. 4. *Gastro-duodenal lesions.*—(*a*) Acute gastritis; (*b*) chronic; (*c*) solitary acute ulcer, wherever its situation in stomach or duodenum; (*d*) solitary chronic ulcer; (*e*) multiple ulcers. Wherever within the limits of stomach and duodenum the lesion exists the position of the maximum point in the abdominal wall is constant—mid-way between ensiform and umbilicus. 5. *Small intestine lesions.*—(*a*) Strangulation by band; (*b*) inflammation of a Meckel's diverticulum; (*c*) some cases of typhoid; (*d*) carcinoma at ileo-cecal junction; (*e*) infection of small gut mucosa. Wherever the lesion in the small intestine (*i. e.*, in jejunum or ileum) the position of the maximum point of hyperalgesia on the body wall is constant—at the junction of the upper and adjacent fourths of a line from umbilicus to symphysis. 6. *Great gut lesions.*—In his experience great gut lesions which have given rise to hyperalgesia have been growths from the splenic flexure down, and the maximum point on the body wall has been constant in position—at the junction of the lowest and adjacent fourths of a line from symphysis to umbilicus.

In 1902 Kelling proposed *inflation of the abdomen with air* for diagnostic purposes prior to *x*-ray examinations; a decade later Weber modified this by using oxygen. Stein and Stewart[2] give an account of their experience with this modification. After the usual thorough cleaning out of the bowels and emptying the bladder, the patient is put flat on back, and abdomen inflated with 3 to 4 quarts of O. The only outfit is a tank to which is attached a rubber bag (such as used in gas-oxygen anes-

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(2) Annals of Surg., July, 1919.

thesia) of 1 gallon capacity. To bag is attached a small rubber tube which can be easily connected with a lumbar-puncture needle. The spot is sterilized with iodin and skin anesthetized by novocain-adrenalin. The spot from which it is easiest to inflate is 2 or 3 fingers to l. of umbilicus and about 1.5 in. below. Anyone who has had surgical experience can easily gauge the thickness of the wall. Push the needle to a point where it touches the fascia; then stop for 1 or 2 seconds. After that the needle is pushed through fascia, muscle and peritoneum without any difficulty. The plug is then removed and needle connected with the rubber tube. A slight pressure on the bag will now inflate oxygen. As a rule, this takes between 4 and 5 min. and the amount to be introduced nearly a gallon. When entirely distended patient usually complains of fullness and slight pains in shoulders (the latter apparently due to pressure against the diaphragm). The oxygen is usually absorbed without any trouble within 24 hours. Far from being in the least injurious, oxygen has been found to lessen postoperative shock, nausea and vomiting. The gas is non-irritative to the peritoneum and the organs. The elasticity of the intestines permits them to recede before a needle, provided caution is used and the needle advanced slowly.

Within 2 to 3 hours patient should be referred to the röntgenologist. This method permits the examination to be made in the most varied positions, standing or lying down, and all of the solid organs are revealed with a clearness heretofore impossible. *E. g.*, in the erect posi-they secured beautifully contrasting röntgenograms of the diaphragm, liver and in many instances the gall-bladder attached, normal spleen with its pedicle and both kidneys.

In the horizontal position, with patient's back to table, they were able to demonstrate some very marked post-operative adhesions between intestines and peritoneum; also demonstrated with great clearness a large carcinoma of asc. colon. Pathologic conditions, carcinomatosis, cirrhosis or marked hypertrophy of liver, enlargement of spleen and tumors of stomach and intestines, as well as those of the genital organs, are now easily demonstrated. This procedure is not a competitor of the opaque meal method, as the latter concerns the hollow organs of the abdomen, whereas this method is concerned mainly with the parenchymatous organs. It will be a great help in the Röntgen diagnosis when used with the barium meal.

Anesthesia. L. L. Stanley[3] gives his experience with *spinal analgesia in surgery of the upper abdomen.* Of 603 operations, 68 required incisions between the nipple line and the umbilicus. In 52 of these upper abdominal operations, the blood pressure fell, the greatest drop being 76 and the least 2 mm., with an average fall of 28. In 3 there was no change, and in 6 the pressure was higher at the end than before.

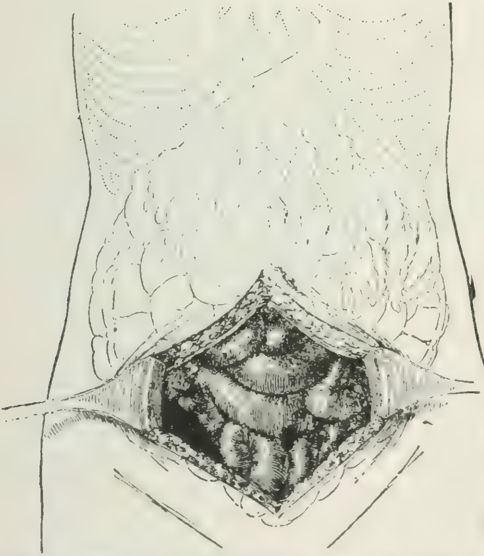

Fig. 115. Amount of small intestine in pelvis when patient is anesthetized in dorsal position (Guthrie).

This anesthesia in upper abdominal surgery is a distinct advantage over the inhalants. Anesthesia is more quickly induced. Within 5 min. after the patient comes to table the operation may be begun. No anesthetist is

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(3) California State Jour. Med., June, 1919.

needed, the surgeon himself giving the spinal injection. A nurse or attendant should be on hand, however, to note pulse and respiration. The abdominal walls are thoroughly relaxed, and sewing up is a very simple matter. There is very little shock because the cord is temporarily blocked, and no harmful impulses reach the brain. There is seldom any vomiting, except what might be expected after a gastroenterostomy. No foreign substance is secreted in the stomach to produce emesis. No pneumonias follow, for the lungs are in no way affected.

D. Guthrie[4] is convinced that *Trendelenburg anesthesia in pelvic surgery* plays an important rôle in prevention of postoperative ileus and shock. The object being to rid the pelvis of as much of the small intestine as possible before the abdomen is opened. It is best employed with ether, though he had fair success with gas-oxygen. If the anesthetic is given in an anesthetizing room, the patient is put on table and anesthesia started in high Trendelenburg position. The method cannot be employed successfully except by a skilled anesthetist who can allay the fears, for the objections are it may frighten the patient and that the position may be uncomfortable.

It has been asked why it is not possible to begin in the dorsal and change to the Trendelenburg position as the patient is getting under the anesthetic, or to wait until fully anesthetized and then change to the Trendelenburg before making the incision. Guthrie tried both these methods, and they do not work with the same success.

If the anesthetic has been given successfully and the patient has not strained or coughed while going to sleep, it is usual to find only a coil or two in the pelvis, provided, of course, the intestine is not adherent to the pelvic structures. Through a small opening in the peritoneum, 2 fingers are inserted into the cavity, and the abdominal walls are well lifted up The inrushing air will cause any coils which have not gravitated out of the pelvis to slide up, so it is usually necessary to employ only one small gauze square to get excellent exposure. In comparison with anesthetizing the patient in the dorsal position, making the incision and then calling for the Trendelenburg position, it is amazing to see the difference in

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(4) Jour. Amer. Med. Ass'n, Aug. 9, 1919.

the amount of gauze necessary to use to obtain exposure.

In the discussion A. J. Ochsner said as to when the foot of the bed is to be elevated, it does not matter so much so long as the table is elevated several min. before the operation is begun. Bell (Montreal) directed attention to the fact that when he anesthetized patients in the moderate Trendelenburg posture they did not inspire any mucus, and consequently at that time when most surgeons had many cases of ether pneumonia he had none. Of course, the inspiration does not begin until patient is fairly well anesthetized because the patient protects herself before that by swallowing the mucus, so that this feature will be equally well taken care of if the patient is completely anesthetized in the horizontal position, and then before the ultimate preparations are made for the operation the foot of the bed is elevated, but one can tell the difference every time in the position of the intestines in patients

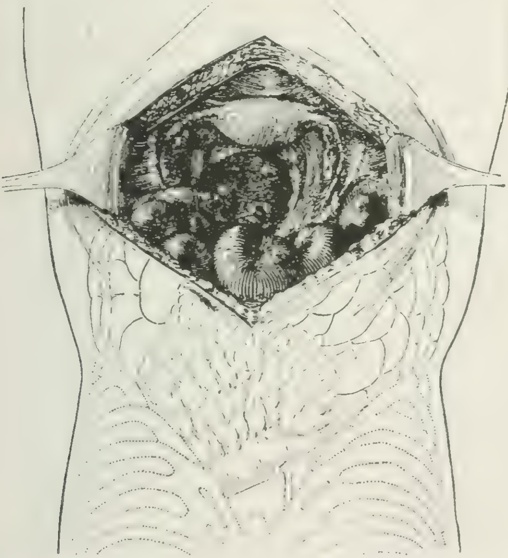

Fig. 116. When patient is anesthetized in Trendelenburg position coils are gravitated out of pelvis (Guthrie).

remaining in the horizontal position until the abdomen is opened. For 20 years Ochsner has invariably directed that the foot of the bed be elevated when the operating table is wheeled into the operating room. He is absolutely sure that Guthrie's plan is of tremendous value.

Incisions. Among other cases operated on as "emergency surgeon" by A. S. Tymms[6] were *140 of abdominal conditions:*

An absolute diagnosis was often not possible, and where there was a doubt, a good deal of judgment was required in its performance. Whether to open above or below umbilicus was not always easy to decide, especially in the acute crises, where no indication could be obtained as to the primary cause. Unless some fairly definite indication existed for selection of the upper segment, the subumbilical incision was chosen. A preliminary 8 in. suprapubic stab was of great value in localizing the primary cause in an "acute abdomen." Here the character of the fluid, the escape of gas and its odor would enable one to distinguish the position of the lesion. One could generally recognize gastric contents by their odor and appearance in perforation of stomach or duodenum; bile in perforated gall-bladder; pus with a fecal odor in appendicitis; turbid, fecal-smelling fluid in perforation of the intestine; clear fluid in early cases of obstruction from malignant disease or adhesions; blood-stained fluid in late obstruction or pancreatitis; pure blood in rupture of a solid viscus.

This evidence, taken with any other helpful factors in the case, would determine the ultimate site of the incision, while the stab incision could be used for drainage, and closed as desired. It was always advisable to ensure that the bladder had been emptied previously. In obstruction the midline subumbilical incision was invariably used. In deciding between a muscle-splitting or a midline incision in a female when the diagnosis lay between appendicitis or a pelvic condition, preference was given to the latter, since the patient was over 18, the abdominal signs low down and pelvic history and examination suspicious, but not definite. If a patient were under 18 and the diagnosis of appendicitis was

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(6) Med. Jour. Australia, Nov. 16, 1918.

doubtful on account of pelvic symptoms, the McBurney incision was almost invariably found all necessary. In appendicitis the position of the muscle-splitting incision was varied from high to low, from the midline to the extreme lateral region, according to the evidence obtained as to the maximum tenderness, or the position of a mass or thickening ascertained just prior to or after anesthetization. This would not, however, always obtain, as in quite a number the maximum or only tenderness was in epigastrium. In general peritonitis following appendicitis the midline afforded the best approach, as it often dispensed with the necessity of making a McBurney incision and provided for better drainage. It is only in the occasional high cecal cases, with a retrocecal appendix, that this fails to give access to the appendix. One found the r. rectus muscle-splitting incision of great value where a differentiation between gallbladder, duodenal or appendiceal lesion could not be accurately arrived at before operation. It could be made opposite the umbilicus, either a little above or a little below this level, according to which condition was suspected to exist. It would be of small dimension until the lesion was localized, whence it would be enlarged cranially or caudally, as desired. The upper abdomen was usually opened through the r. rectus, unless l. side were definitely indicated, and the muscle was split with fingers rather than cut, as the nerves and muscle fibres were not damaged. This incision gave more room and damaged the muscle less, than by retracting the muscle laterally. Retraction medially is unsurgical.

The trans-rectus incision in the upper abdomen is praised by R. E. Farr.[7] Generally speaking, the gallbladder is exposed by dividing the r. rectus above the umbilicus on a level roughly corresponding to lower border of liver; the stomach by division of l. rectus. In either we go across the l. alba; the incision may be supplemented by a vertical limb extending to ensiform if need be. In this latter avoid the l. alba by preference, dividing first the ant. and then the post. sheath of rectus .5 to 1 in. away. In a large number of instances Farr

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(7) Minnesota Med., May, 1919.

removed the appendix through the transverse gallbladder incision without extending it.

For the control of hemorrhage, a light, angular Pean forceps with one blade behind the muscle, the other in front is made to include the aponeurosis. The muscle is divided between these clamps which remain throughout operation. The upper segment of the muscle is gently loosened from the transversalis which is then split in the direction of its fibers; or it may be divided in a diagonal direction corresponding to the Kocher gallbladder incision. Farr's preference is for a curved incision in the post. sheath which in a general way follows the line of that in anterior sheath. It is, however, somewhat farther from the midline and slightly higher than the one in front of rectus. The posterior flap has a curved rather than a rectangular form.

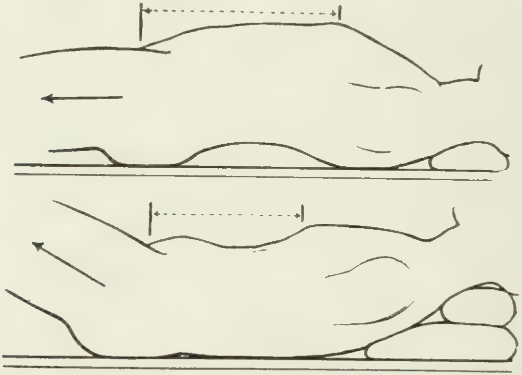

Fig. 117. Showing how distance between pubes and ensiform may be shortened, relaxing the wall and relieving the incision from tension (Farr).

Drainage is carried out by a stab, generally above the incision in flap, but below in case the tube would more naturally lie in this position. Postoperative hernia is in this way guarded against to some extent. Enthusiastic reports might lead to the belief that hernia does not occur. His experience shows hernia does take place in cases that suppurate or in which drainage has been carried out through the incision proper. Farr has had no hernia in cases that healed primarily, and believes hernia is less liable after transverse incisions.

A mattress suture, continuous or interrupted, closes the peritoneum and transversalis, everting the former and taking up some of the slack in post. sheath, thus aiding in approximation of the cut ends of muscle. The ant. layer may be imbricated provided necessary to approximate the muscle, using a continuous or interrupted mattress suture.

In injury to organs in the vault of the diaphragm—convexity of liver, upper pole of spleen, cardiac portion of stomach—the injury occurring by way of the chest, it has been found best to have the incision follow the course of the injury; *i. e.*, after thoracotomy and attending to the injuries inflicted on the intrathoracic organs, the surgeon deliberately incises the diaphragm or enlarges the visible wound in the same and deals with the abdominal organs as the case may demand (*trans-thoracic—or transdiaphragmatic—laparotomy*).

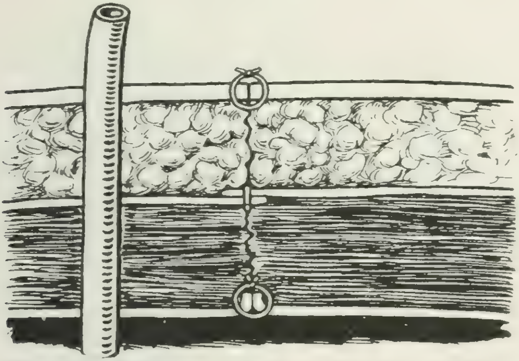

Fig. 118. Sectional view of closed wound (Farr).

W. Meyer[8] used this route successfully in a man, of 31, shot Nov. 29, 1918. On Jan. 8, following the bullet was extracted from the liver. He states the conclusions that could be drawn from this and others are:

Recent wounds which have entered the abdomen

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(8) Annals of Surg., August, 1919.

through the chest and have likely seriously injured one or more of the principal organs within the vault of the diaphragm are best promptly explored by a transthoracic laparotomy. Injuries to the convexity of liver or upper pole of spleen, without previous penetration of the chest, if not satisfactorily accessible from below, can be thoroughly attended to by the surgeon if he follows the transthoracic route. The experience gained in general in the War would seem to hold good also for bullet wounds of the convexity of liver in times of peace, *viz.*, to remove the missile and therewith eventually avoid more serious consequences later on. Whether the operation should be done immediately after accident or later depends upon the seriousness of the concomitant symptoms. If a prompt, transdiaphragmatic attack is not imperative by increasing symptoms of pressure-pneumothorax or severe internal hemorrhage, a secondary operation may be best. These operations are best done with some differential pressure apparatus. In case of the necessity arising to leave tampons in the abdomen, it appears best, from a surgical standpoint, to deliver them through a special abdominal stab. The diaphragmatic wound can then be sutured, and thus the physiologic separation of thoracic and abdominal cavities be reestablished. Temporary air-tight drainage of the chest appears here, too, to be the safest procedure for after-treatment. The establishment of an artificial pneumothorax and oxygen insufflation into the abdominal cavity bid fair to make the röntgenologist definitely localize the bullet if it be found near diaphragm.

Wound Closure. J. N. Jackson[9] describes a simple, effective *suture for difficult peritoneal incisions.* Their closure is at times a matter of much difficulty. This may be due to tension from muscle retraction, and in others to thinness and friability of the peritoneum itself. This is particularly true of incisions in upper abdomen. Jackson rather accidentally, fell into use of a cross-buck mattress suture. It is exceedingly simple and has proved altogether satisfactory. First, a simple transverse suture at the lower (or upper) end of the wound is tied. It is a continuous suture. The needle

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(9) Surg., Gynecol. and Obstet., October, 1919.

on the long end of suture is now introduced from without in about ⅛ to ¼ in. above the primary suture. It passes obliquely forward and is brought from within out, at a point about the same distance forward of the point of entrance. It is now brought back to a point opposite the beginning and introduced on the opposite side from without in. Again, obliquely it is advanced and brought from within out ⅛ to ¼ in. forward of the beginning point of introduction. It is now drawn taut and the next stitch begun. It is thus an X or cross-buck mattress stitch. Where there is much tension or a very friable peritoneum a liberal bite of muscle may be taken in each stitch. When each stitch is drawn taut it does not cut out. The peritoneum is also everted leaving no raw surfaces on the inside.

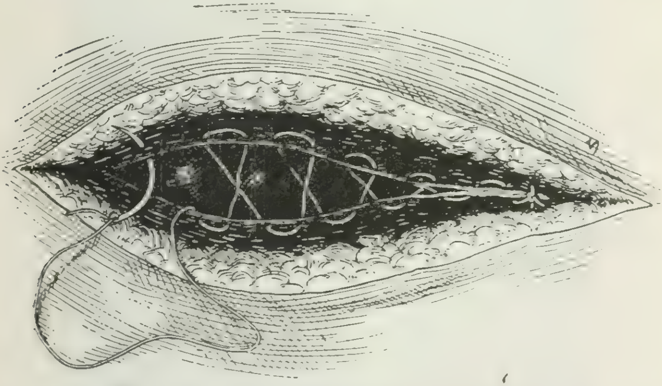

Fig. 119. Cross mattress suture (Jackson).

Drainage. Attention is called by A. E. Maylard[1] to the *disadvantages of gauze packing in abdominal operations.* He has several times noticed that, on withdrawal of a gauze pack which had been left for a few days after operation, a fecal discharge has, if not immediately, in a day or two, ensued. One could not be certain that the gauze was the cause; but the sequel has been too frequent not to make one somewhat suspicious of its

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(1) British Med. Jour., Nov. 1, 1919.

being so. It was only after noticing the very striking and comparatively rapid effect of a piece of dry gauze in contact with the bowel for so short a time as 30 min. that his suspicions seemed confirmed. But with such results as those which accrued in other cases it is hardly possible any different course would have been pursued by the gauze had it been dry or moist. For, if dry, it must soon have become soaked with the exudates, and so acquired much the same condition as that originally inserted moist. It is reasonable, however, to infer that a solution such as that made with sodium citrate, when saturating gauze tissue, will render it less irritating to the peritoneum—than if the material had not been so treated and had been employed dry.

There may be said to be 4 other disadvantages from gauze packing, and these are in more or less direct proportion to the length of time the packing is retained. One is employed in septic cases without a drainage tube, it may act as a dam to the escape of any discharge. A second is the possible and, indeed, probable irritative effect upon neighboring coils of healthy bowel, leading to a low form of adhesive peritonitis. Coils may thus become matted together or to the parietal peritoneum, and the adhesion may in some way lead to obstruction. A third disadvantage is whenever an opening is maintained through the parietal wound for any time—and the longer the more likely—a weakened cicatrix is almost the inevitable precursor of a hernia. And, lastly, the withdrawal of a gauze pack is very painful.

For *peritoneal drainage*, C. L. Heald[2] finds the double caliber glass tube with movable gauze wick, comes nearer meeting requirements than any method used. The double tube is ½ in. in (outside) diameter. The lower end is closed except for an oval opening ⅛ in. in its long diameter, ¼ in. from lower end on each side, and a small opening in the bottom.

One end of a gauze wick, 1 in. wide and several yards long, is inserted in the upper end of one "barrel," and pushed down lumen to the lower end with a small probe, pulled out of the opening in the bottom, the end rein-

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(2) Surg., Gynecol. and Obstet., March, 1919.

serted in this opening and pushed up through other "barrel," passing around the smooth lower end of septum. The tube, with the wick, is inserted to bottom of cavity, and wound closed completely about it. It should be long enough to project above the dressings, which are covered by a rubber dam, through a small stretched opening in which the tube has been previously passed. The roll of sterile gauze wick in a cloth bag is pinned outside the dressings and covered with a sterile towel. For first 24 hours, at more or less frequent intervals depending on amount, the nurse with sterile-gloved hands, steadies the tube with one hand, pulls the wick through with the other until dry, cuts off the soiled portion and replaces the sterile towel without having disturbed the patient. After 24 hours, the tube is removed and replaced by a small cigaret- or any form preferred. The method may be used in drainage of any cavity where dependent drainage is impracticable, but will probably be of most use in peritoneal infection from perforation. It is not necessary to leave a

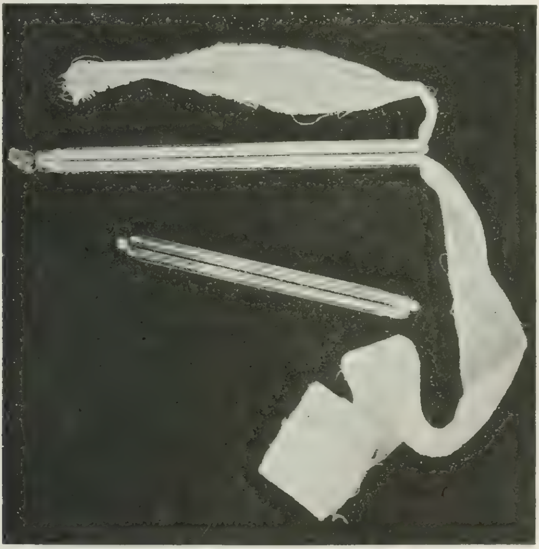

Fig. 120. Peritoneal drain (Heald).

large portion of wound open, as with the usual methods, often resulting in hernia.

Postoperative Thirst. *Thirst following abdominal operations* is often so intense that the memory of it lingers for many years. This distressing thirst not only makes the patient wakeful and irritable but it has an important physiologic meaning as well, because it is the direct result of the anhydrous effect of the anesthetic upon the tissues, of the loss of blood and peritoneal fluid during operation and especially the depletion in the vascular system incident to preparation for operation.

Three years ago, to overcome these conditions a standing order was given in all B. Van Hoosen's[3] operative cases of a 3-quart enema of tap water, temperature about 100° immediately following the operation, or as soon as patient was returned to bed. This enema was given fairly rapidly not over 10 or 20 min. being required. An ordinary colon tube was used and the water poured into the funnel. The patients, almost without exception, retained the entire 3 quarts. The fact that an enema of so much larger amount than usual can be retained at this particular time is largely dependent on the patient having had, preliminary to the anesthetic, either morphin and scopolamin or morphin and atropin. In addition to this preliminary anodyne all patients, who were given the water by rectum, were also given morphin, 1/32, and scopolamin 1/200 every 4 hours during the first day and occasionally the second day.

Catheterization was rarely necessary. The secretion of urine was not accelerated during the first 12 hours but after that became very active, the patient often voiding every hour for a few times. Thirst was entirely relieved. Occasionally patients even refused water for 12 to 14 hours following operation. Shock was prevented. The heart action was better sustained by the well filled bloodvessels. Gas pains were less frequent. Wounds healed more quickly and more firmly and resisted infection better due to the more normal circulation. The patient was well fortified to bear possible secondary hemorrhage or excessive loss of fluids due to prolonged or profuse vomiting. In pelvic operations

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(3) New York Med. Jour., March 22, 1919.

the distended rectum gives the small intestine less opportunity to fall into the cul-de-sac and become adherent. Albumen and casts more rarely appear in urine.

Of the water injected the greater part was absorbed and never excreted by bowel or kidney. Three-day records of the intake of liquids and the loss by vomitus or urinary secretion showed the patient retained permanently 5 pints of the water injected. It is interesting to know something about the distribution of water introduced too rapidly for immediate absorption. To determine this, 3 quarts were injected after completion of the operation and before incision was closed. The abdomen was then explored and the rectum found fully distended, sigmoid nearly empty, desc. colon fully distended, transverse colon partly distended, and the asc. colon containing a small amount, as did the cecum. The small intestine was quite empty. Immediately following the closure of abdomen 2 quarts more were injected and the entire 5 quarts retained with the usual good results. Since the introduction of the large (3 to 5 quart) postoperative enema such orders as cracked ice, ice bags to the throat, and various other time consuming methods are not known in the surgical wards.

Parotitis. In 1915, four of the patients of C. U. Collins[4] *developed parotitis,* and 3 died. He then looked up his records and found of 6,100 patients operated on, 7 developed parotitis; another developed it and died prior to operation. Five were males, 3 females. All had had abdominal operations except one and he had peritonitis following appendicitis. Three were operated on for obstruction of the bowels, 2 for ulcer of stomach, one had a panhysterectomy done, and 2 had peritonitis. In 5 both glands were inflamed and in 3 the r. gland only was affected. Of the 5 who died 3 had abdominal conditions that might have caused death anyway, but in 2 the parotitis was evidently the principal cause of death. In 6 there was no positive evidence of suppuration. Of the 4 that died, 3 died in such a short time there was hardly time for suppuration to become manifest. In 2 suppuration became apparent and the glands were drained.

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(4) Surg., Gynecol. and Obstet., April, 1919.

Collins is of the opinion that postoperative parotitis is more apt to occur after abdominal operations than on any other part. Its development is favored by a dry mouth and a lack of fluids in the body. The infection usually ascends through Stenson's duct. In patients whose abdominal condition makes it necessary to withhold food and drink from the mouth and stomach for a time, prophylactic treatment should be instituted. The mouth should be kept clean and moist by its own secretions and the body abundantly supplied with water. A good way to keep a current of saliva flowing *down* Stenson's d. is to have patient *suck* on a stick of lemon candy after operation. A very accurate and effective way to supply the body with fluid is to administer salt solution by hypodermoclysis.

If the prophylactic treatment fails and parotitis develops and the inflammation is increasing, or is no better by 3d or 4th day, the gland should be uncovered by a free incision, punctured in several places with blunt forceps and incision packed with wet sterile gauze.

[It is well to induce the patient to chew paraffin, or gum, as soon as the first symptoms of parotitis appear, and to continue this with as little interruption as possible. This plan of treatment, if begun reasonably early, will abort an attack of postoperative parotitis in almost every case.—Ed.]

J. B. Deaver(5) also takes up *postoperative parotitis*. The first reported cases all followed ovariotomy or other operation on the female organs. Paget, however, as early as 1886, reported on 101 cases, 51 of which took place after operation on the upper abdomen, as well as after herniotomies, colostomy, tumors, and penetrating injuries; 50 followed operations on the female organs. While at present, secondary parotitis occurs more frequently after operations on the genitalia, especially in the female, the relative proportion has been considerably reduced. In fact, the type of operation, *i. e.*, the organ or organs operated upon, plays a minor rôle. Cases occurring in his experience may be reasonably attributed either to peculiarities of the pathology encountered, to local conditions, or to postoperative wound infection.

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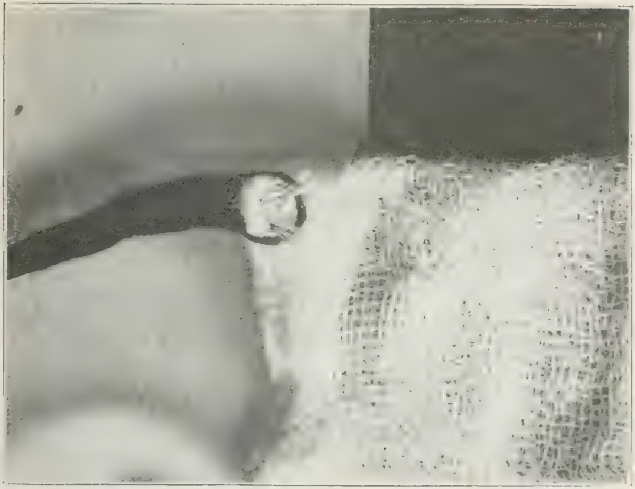
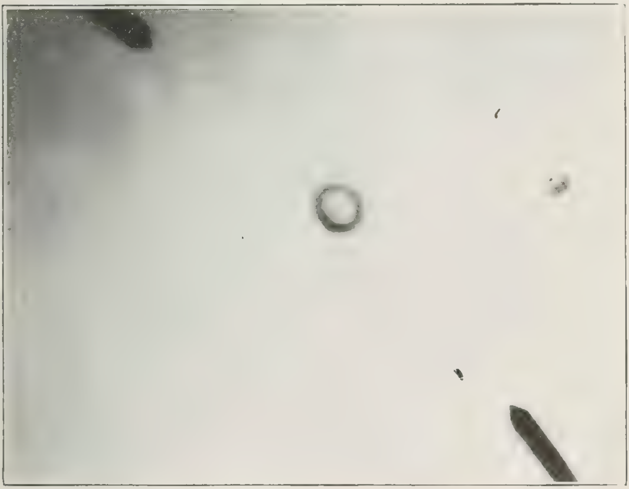
(5) Annals of Surg., February, 1919.

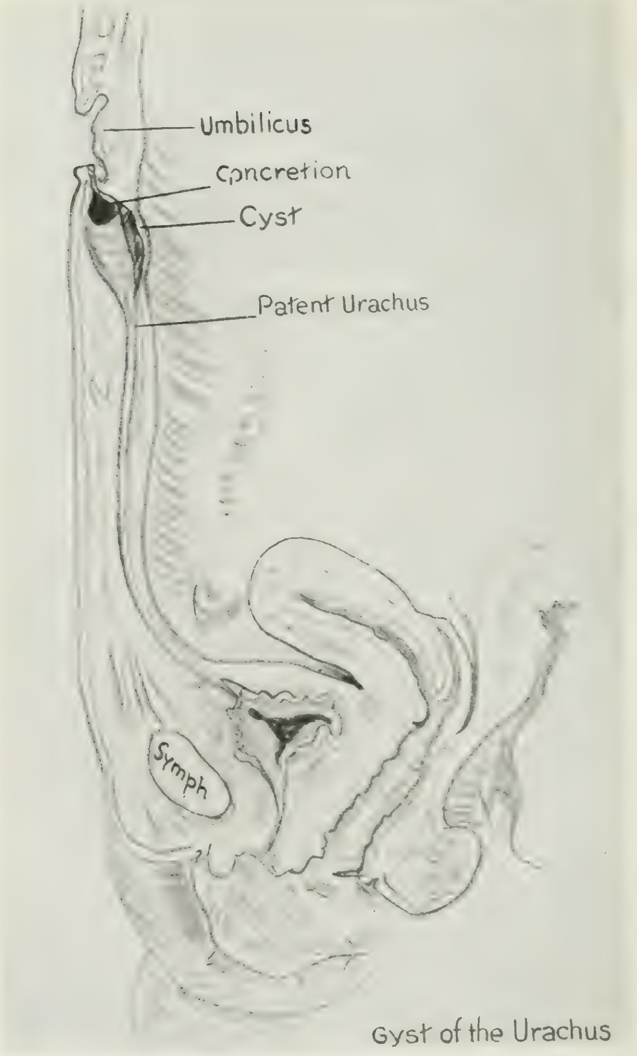
PLATE XIII.



Abdominal sponge with ring attached.



Roentgenogram showing sponge through a 200 pound patient.—Masson. (See p. 354.)



Suppurating urachal cyst.—Ward. (See p. 357.)

Postoperative parotitis may be classed into: metastatic, occurring only in pyemic conditions; ascending parotitis due to ascending infection *via* the excretory ducts; and traumatic, the result either of direct pressure on the parotid or the forcible manipulation of jaw by the anesthetist. The anterior of the 2 large processes of the inner surface of the gland passes into the glenoid fossa behind the articulation of the lower jaw, therefore it can readily be seen how injury to this process can occur. A more frequent traumatic factor, however, is the anesthetist pressing on that part of the gland which extends down behind the angle of the jaw into neck.

Infection may be carried by way of the lymphatics from diseases of neighboring structures, by way of the blood-stream, and by way of Stenson's duct. The latter route seems very plausible since the mouth harbors numerous bacteria to the increased virulence of which, especially staphylococcus infection may be due. While in view of the fact that to-day the asepsis of mouth receives considerable attention before and after operation this theory may lose some of its practical value, the fact remains that infection can take place by the ascending route. It is interesting to note that in recent times the majority of the cases have occurred after severely infected conditions, appendicitis, peritonitis, perforating gastric ulcer, etc. In fact, next to ovarian cyst, perforating ulcer is said to be the most frequent operative condition which is followed by secondary parotitis. Why the infection sometimes chooses the parotid and so often does not, is not easily explained, except perhaps by the trauma, already referred to, or by individual disposition. That such disposition exists is generally admitted.

Sometimes the dry mouth following anesthesia is given as a factor. This might apply to cases within a day or two, but most occur between 3 and 7 days. Withdrawal of food per mouth and resulting absence of oral secretion has also been accused. Indeed a number of cases are reported to occur during the starvation treatment in unoperated cases of (supposed) gastric ulcer. There seems little doubt, however, that interference with normal salivary secretion and with the protective action of the saliva as it drains down may be responsible in such instances.

Adhesions. *To prevent postoperative abdominal adhesions*, W. R. Bagley[6] advises: First make as small an incision as can be worked through with accuracy. Get more sutures covered especially those not of plain gut. Utilize especially the sigmoid and omentum in covering all raw surfaces, not that these tissues are immune to the disadvantages of adhesions, but they are less so than the other abdominal contents. Keep the small intestine as remote as possible from the field. Encourage a frequent change of position in bed, not overlooking the raising the foot in pelvic cases where permissible. The abdominal dressing can have an important bearing upon adhesions. The primary object of this is reinforce sutures and protect the incision from outside contamination. Bagley believes in firm pressure at this point, but as frequently dressed the whole abdominal pressure is equalized, and shifting of abdominal contents, interference with which is a detriment in most cases.

An *experimental study of abdominal adhesions* has been made by Behrend and Rothschild.[7] They believe adhesions are due to mechanical, chemical and infective agents. The ideal condition at operation will have been attained when we can discard the use of chemical substances. The majority of adhesions are formed as the result of the contact of the sensitive endothelial lining with the various chemicals used in the local preparation. In these days of asepsis infection forms a small minority. The less the abdominal contents are handled the fewer adhesions will naturally result. There is no substance that will prevent adhesions absolutely. The use of rubber dam was a distinct failure. Iodin gives the densest adhesions; alcohol 95 per cent. showed adhesions in all animals used; dichloramin-T gave the best results both in the primary operation and afterwards in the prevention of reformation.

Foreign Bodies. An *extra tag on the abdominal sponge* is urged by J. C. Masson.[8] About 27,250 abdominal operations have been done at the Mayo Clinic

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(6) Minnesota Med., February, 1919.
(7) Pennsylvania Med. Jour., June, 1919.
(8) Jour. Amer. Med. Ass'n, May 31, 1919.

in 5 years, and 13 were on patients sent in for removal of sponges. With a view to the special marking of all abdominal sponges, he has them made with a metal ring around the base of the tape and firmly sewed to both sponge and tape with strong thread. If a sponge is reported missing, the abdomen may be roentgenographed before it is reopened; the sponge will be revealed by the metal band. In hospital practice this procedure should be especially applicable, since if a sponge is reported missing and any one of 2 or 3 patients may be the unfortunate retainer, roentgenograms may be taken of all, and a difficult situation is cleared up with minimum trouble. (Plate XIII.)

Finding of a large *foreign body free in abdomen* is recorded by G. Chavannaz.[9] A man, aged 65, for over 10 years had noticed a small mass in l. flank; at first supposed to be a movable kidney, it began to cause pain, and a few months previous commenced enlarging, and passed over to r. side, assuming various positions according to whether standing, sitting, etc. The pain now became more violent, radiating to groin, lumbar region, etc. Operation was undertaken for a supposed benign growth of omentum, but after opening abdomen the mass was at once extracted. Histologic examination showed it to be a "pure fibrous tumor."

[While M. Chavannaz adds the origin is difficult to determine, the account reads as though an appendix epiploicus had undergone torsion, and finally loosened. Where the twisting is slow the vessels gradually become obliterated, and the serous covering has been found fibrous, cartilaginous, even calcareous. Such foreign bodies have been found almost everywhere, in hernial sacs, also between diaphragm and liver, having been there for a long time and produced a depression exactly same size and shape in the liver. Of 60 cases reported, no less than 47 were in males, another corroborating point.—ED.]

In addition to the cases of migration of projectiles in the heart and vessels, M. Barthélemy[1] met with *2 in abdomen:* (I) Several *x*-ray examinations always showed bullet at same point in hypochondrium of l.

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(9) Presse Méd., July 31, 1919.
(1) Paris Méd., Sept. 20, 1919.

side, .8 in. in front of spinal column, and 1.2 from midline. At operation the day after last examination the missile was not found, it was finally discovered in mesocolon not far from cecum. (II) Entrance wound .8 in. below umbilicus, bullet seen with *x*-rays at a depth of 1.2 in. and an equal distance to l. of entrance. Soon after found at operation in exact centre of abdomen.

Abscess. An *intraperitoneal abscess containing roundworms* was operated on by F. H. Jackson.[2] A girl, of 16, was admitted April 27, over a year previous (Jan. 27), she had been in hospital for ruptured appendix. Present complaint very severe pain in entire lower abdomen. In view of the previous operation and the findings the diagnosis was an intra-abdominal abscess, of appendiceal origin, with a low grade obstruction.

Operation through the old incision, taking out the scar. The omentum was adherent to the intestine and pelvic contents. A large abscess was found on r. at the pelvic brim. He went through the adherent omentum into the abscess, because removal of the adhesions seemed unwise. The abscess contained something like a quart of intensely fetid pus, and 2 live lumbricoid worms. The wall had a look that was very suspicious of tuberculosis. No opening between the intestine and abscess found, and the cavity was drained by a large cigaret drain, the abdominal incision being left with a rather generous opening. It was felt better to take chances with an incisional hernia than with failure to drain such a fetid mass.

At a meeting of the N. Y. Surgical Society, W. S. Schley,[3] presented a boy, of 9, who had had an *intraperitoneal abscess from a fishbone* perforating the bowel a year previous. Several weeks before admission he complained of indefinite abdominal pain. Three days before the pain recurred with considerable severity and localized upon l. side near umbilicus. The boy had been rather careless as regards his bowels and had been a rapid eater. On admission he had an acute intra-abdominal condition with rigidity, etc. The omentum was found to be wrapped in a ball-like mass completely

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(2) Jour. Amer. Med. Ass'n, Feb. 8, 1919.
(3) Annals of Surg., June, 1919.

around an abscess, and in contact with the desc. colon and the small intestine behind to both of which it was adherent. On opening the mass it was found quite a large (codfish) bone had perforated from the large or small intestine; it was impossible to say which. The discomfort experienced prior to the acute onset was probably at the beginning of the perforation of gut. Schley excised the mass of omentum and placed in a small drain. In the specimen presented the protective action of the omentum is well shown.

Abdominal Wall. *A suppurating urachal cyst* with concretion, was met with by W. G. Ward[4] in a woman, of 44. For 10 years previous she had had considerable moisture in the umbilicus, which at times smelt like urine. She had to wear a cloth pad all that time, and every day had to cleanse the parts to prevent irritation. Ward found a round mass, about size of orange, just below navel, and apparently in direct contact with its lower border. The umbilical wall obviously somewhat elevated and reddened. The floor bathed in a thin, watery pus, odor of urine present. The mass hard and brawny, and slightly movable sidewise, with apparent fluctuation. No swelling of inguinal glands.

At operation, the walls of the cyst, as cut through, had a fibrous, gritty feel. On entering the cavity, about 8 oz. of a yellowish, very fetid pus exuded. At the umbilical end of the cyst, Ward found an oval-shaped mass, strikingly like fine yellow cornmeal, 1.5 by .75 in. The removal of this mass disclosed a very small aperture, opening directly on floor of umbilicus. The cyst cavity would measure about 3 in. long by 2 wide, and its walls were remarkably smooth. The cyst was closely adherent both to peritoneum and fascia, and he did not attempt to dissect it out, simply swabbed out the cavity with iodin, and packed with iodoform gauze. The patient began to improve in health almost immediately: the wound healed rapidly from the bottom, so that in 2 weeks she was discharged with a firm scar. The thick fibrous wall apparently melted away in 4 or 5 days. The oval mass had acted as a ball-cock. For several years, the patient had frequent desire to urinate, but

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(4) Annals of Surg., March, 1919.

as soon as the abscess formation began this ceased and urination became normal. (Plate XIV.)

W. Van Hook[5] gives a description of his *laparoplasty*, which is indicated where the abdominal walls are greatly relaxed, or where the wall has been injured. It does not directly modify the upper abdomen, but both shortens and narrows the walls of the lower abdomen, thereby diminishing its volume. The technic is as follows:

Any necessary intra-abdominal work having been performed and the peritoneum having been closed; or any median hernia having been brought to the same stage of completion, the plastic work may be undertaken. Beginning at a point on midline a little above the symphysis, incisions are carried at right angles to right and left as far as the outer rectus borders; there the direction of the incisions is changed so they run parallel with the fibres of the ext. oblique aponeurosis. These incisions are carried not only through the skin and subcutaneous tissue, but also through the anterior plate of the rectus sheath and through the aponeurosis of the outer oblique muscles and, beyond the limits of the aponeurosis, through the ext. obliques themselves. But since the incisions are parallel to the principal fibres, but little muscle tissue is injured and both nerves and vessels are left practically intact. A median incision with a closed peritoneum being presupposed we now have 2 equal, pointed and somewhat triangle-shaped flaps outlined. These flaps are raised by dissecting up on each side the anterior plate of the rectus sheath and the adjacent aponeurosis of the ext. oblique muscle and finally the muscle-body itself. The operator will foresee that that part of the outer plate of the rectus which serves to complete the enclosure of the muscle must be split by the scissors when encountered. The effect of these incisions is to give us 2 large flaps of which the bases may be as high as desired. These flaps are supplied with vessels and nerves most abundantly. They are utilized by flexing the thighs upon the abdomen so the trunk is also flexed, then causing each flap to overlap the midline and to be carried down to a much lower level than it had previously occupied. In

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(5) Railway Surg. Jour., October, 1919.

the new position the flaps are firmly sutured to Poupart's ligaments and to one another. The effect of the new arrangement is materially to shorten both the longitudinal and the transverse dimensions of the lower abdomen. In obese or pouching bellies the change is pronounced and immediately to be observed. When healing is complete (and abundant time with the maintenance of flexion of the thighs must be allowed) the umbilicus will be found much nearer to the pubes.

The operation gives a renewed feeling of support to the lower abdomen; changes the form of the *cavum abdominis* by diminishing its circumference at the level midway between the umbilicus and symphysis, and by decreasing the longitudinal dimension of that part of the cavum lying below the umbilical level; and tends to diminish the excessive lumbar curve of the trunk that those suffer from who have pendulous abdomens. The operation gives ample opportunity for the retrenchment of the fat of the abdominal wall, often diminishing the weight by many pounds. A further advantage lies in the possibility of patient's increasing his height by adoption of a better standing posture. The skin may be retrenched as needed. (Plates XV, XVI, XVII.)

Influenzal Abscess of Rectus. In addition to several postinfluenzal abscesses about the joints seen at a camp, H. Gage[6] mentions 3 in the sheath of rectus. The patients were 21, 25, and 24, respectively, all 3 contained pneumococci, 2 of them Type I, the other was not differentiated.

In these 3 cases influenza was followed by a secondary infection limited to the recti without any of the general symptoms or of the multiple lesions that usually accompany pyemic processes. We are at once reminded of the degeneration of the abdominal muscles often noted as a complication of typhoid, first described by Zenker (1864). In a series of necropsies during the epidemic at the same camp by Wolbach, lesions precisely similar to those described in typhoid were noted in 9 cases. They ranged from a swollen opaque yellowish-white appearance to large masses of clot occupying considerable areas of the recti. In the microscopic study of sections

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(6) Annals of Surg., August, 1919.

of muscles similar changes, though much less marked, were present in the other abdominal muscles and in the trunk, though rupture with accompanying hemorrhages, except microscopic, were not observed.

Another *rupture of the rectus*, due to influenza, was operated on by W. Balgarnie.[7] A boy, of 11, fell ill Jan. 23, in 6 days he developed bronchopneumonia. Feb. 2, acute pain and tenderness in iliac fossa suddenly developed, suggesting appendicitis. However, the tenderness was most acute at edge of rectus. The general condition was so grave, operation was postponed for 3 days, when the rectus sheath was opened, the muscle was found torn completely across; pulpy and friable under finger, but no extravasation. The appendix itself was not grossly affected: 2 hemorrhagic areas, and midportion dilated with feces. Slow but steady improvement. Balgarnie adds that another boy who died from bronchopneumonia, 2 days before death had tenderness of l. rectus, but no other symptoms, *e. g.*, swelling. He suggests where ruptured rectus is suspected, incision under local anesthesia might be helpful.

[In the 1912 volume (p. 367), is an account by J. B. Murphy, of a rupture of rectus during a swimming contest.—Ed.]

Desmoid Tumors. One is recorded by N. W. Green[8] in a woman, of 28, which started about 3 years previous, size of a walnut, and steadily increased. No pain except when the weather changed the patient felt a sticking pain which did not radiate. On r. side just above superior spine was a tumor, 4.4 by 3.2 in. The skin movable over tumor, latter slightly movable on underlying tissues. *Operation.* The tumor was found growing in the fibres of the int. oblique and transversalis. The ext. oblique was not adherent to it. The tumor was excised, removing with it some of the muscle and some of the sheath of rectus. The edge of rectus was pulled over and sutured to the origin of int. oblique and transversalis, thus closing over the large defect made by the removal. The ext. oblique was then closed in the ordinary manner of the McBurney incision, interrupted chromic gut sutures and overlapping the edges.

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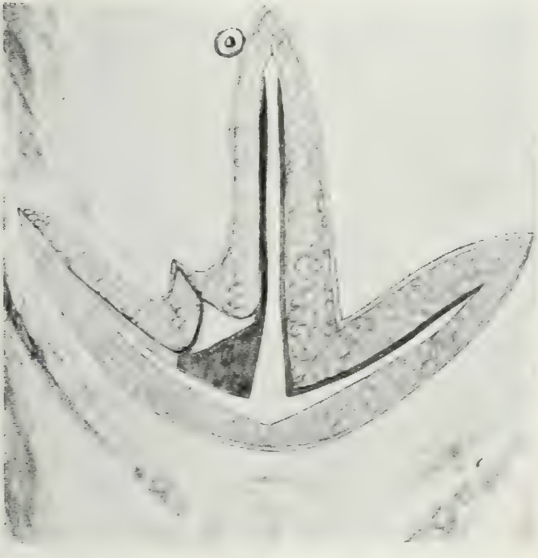
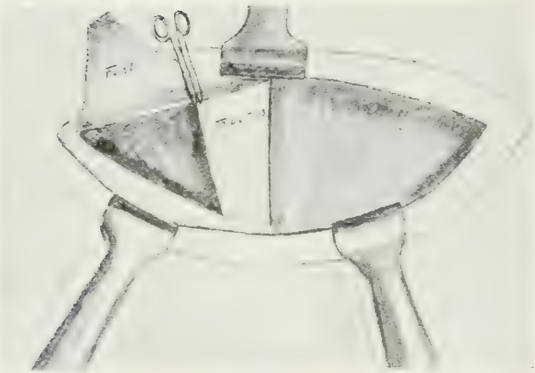
(7) Lancet, May 17, 1919.
(8) Annals of Surg., June, 1919.

PLATE XV.



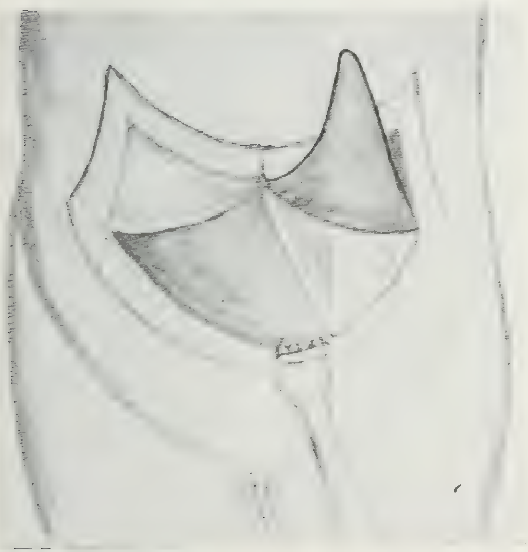
Showing incision and raising of flap on right side.—VanHook. (See p. 358.)

PLATE XVI.



Same. Raising flap for right side, cutting through right lateral wall of rectus sheath.—VanHook. (See p. 358.)

PLATE XVII.



Same. The two abdominal flaps have been formed. The right-hand flap has been carried across midline and sutured nearer the level of pubic bone. Flap for left side is raised and beneath it are seen the bodies of rectus and internal oblique.—VanHook. (See p. 358.)

On section the tumor appeared hard and was pale yellowish pink and 4.4 by 3.6 by 2.8 inches. There was no pedicle. In removing it several large vessels had to be ligated. Microscopic examination showed a mass of connective tissue surrounded by a capsule. The connective tissue consisted of a dense mass of interwoven fibers, which extended throughout the whole specimen. In a number of very small areas it had a somewhat cellular appearance. The tumor as a whole was moderately vascular.

A few years ago in the *Railway Surgical Journal* (1917 volume, p. 366), Balfour reporting 7 cases from the Mayo Clinic, stated 2 occurred in laparotomy scars. These seem to be rare, and the details of *another case,* given by W. C. Danforth[9] are of interest: The patient, age 24, had had 6 years previously a median laparotomy when the appendix only had been removed. The pelvis at that time was said to be normal. She presented a mass in the lower third of scar, easily felt under the skin, hard, tender, only slightly movable. Incision through old scar and an irregular, spherical, hard mass about .8 in. in diameter was excised with its fascial attachment. The abdominal wound was opened. No adhesions to the site of the old wound present. The mass on microscopic examination consisted of hard, fibrous tissue, in bundles, the fibers in many areas giving a wavy effect, the typical picture of desmoid.

The diagnosis of these tumors is as a rule not difficult. They occur most frequently in the sheath of rectus and upon the aponeurosis of oblique muscles. They are usually irregularly round with rather sharply defined borders and when being grasped are not movable upon the underlying tissue. Upon being forcibly moved the underlying wall moves with them. The most characteristic point is that when the wall is under tension they disappear, while when it is relaxed they become easily noticeable. They are ordinarily small but have been noted as large as the fetal head.

Upon diagnosis treatment is quite clear, excised immediately. The excision should include that portion of the aponeurosis which forms the base of tumor. This

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(9) Surg., Gynecol. and Obstet., August, 1919.

occasionally means a considerable area of the underlying aponeurosis must be sacrificed. If so much is removed closure is rendered difficult, closure with transplantation of fascia ordinarily taken from the f. lata must be considered. Excision should be followed by careful microscopic investigation in order the occasional occurrence of malignant growths may not be overlooked.

Danforth also reports *an example of fibrosarcoma:* A patient, of 40, had undergone appendectomy (1911), and abdominal hysterectomy (1915). Several months before entering hospital, she had noticed a swelling at r. side of the lower end of median abdominal scar. This had been slowly growing, moderately tender but not painful. The mass was firm, only slightly movable, not adherent to the skin and gave no impulse upon coughing. Upon operation a mass 2 by 1.6 by 1.2 in. irregular in shape, apparently arising from the fascia of the wall was excised. The underlying portion of fascia was also removed. The peritoneum was opened and abdomen found completely negative. Upon section this mass showed distinct evidences of fibrosarcoma, being composed almost exclusively of spindle-shaped cells with very distinct nuclei closely associated with polarity but little disturbed. She was then given intensive *x*-ray treatment during her stay. A few months later she wrote a growth was reappearing and she was undergoing *x*-ray treatments. She subsequently returned when a mass 6 in. in diameter, hemispherical, red and fluctuating on the top, was found in the lower half of abdominal wound. The surgeon found a tumor, soft, broken down in the middle, densely adherent to the wall, requiring resection of the fascia and part of bladder.

THE PERITONEUM, MESENTERY AND OMENTUM.

Peritoneum. A. Schirmer,(1) from Henschen's clinic, gives the outcome of a case in which *subcutaneous drainage* was done by Tavel in 1911. The patient, at that time 15 years old, had ascites of the premenstrual type.

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(1) Corr.-Bl. f. Schw. Aerzte, Sept. 11, 1919.

The fluid was drained off into the subcutaneous tissues a glass spool being used to keep the channel open, this was ultimately cast off. The general condition was greatly improved, but the collection of fluid under the skin formed huge masses in groins and hung down on thighs until they had to be removed in 1918. The opinion is expressed that the lumbar or retroperitoneal areas promise better results, and possibly instead of glass tubing, etc., animal aorta hardened in formalin might answer, or even a large orifice without a tube.

Peritonitis. W. J. Mayo[2] summarizes his remarks on *acute perforations of abdominal viscera* as follows:

It may be said that a considerable percentage of free perforations are spontaneously closed and that the area of peritonitis is limited through natural processes: the death rate is possibly about 30 per cent. but the 70 per cent. of patients who may recover spontaneously from the attack are not cured.

An exploration through a longitudinal incision just to the right of midline gives an opportunity to make a careful exploration and to deal with any or all varieties of perforation.

Early operation, *i. e.*, within the first 8 hours, barring accident, means recovery, because the stage of contamination has not yet passed onto infective peritonitis, and measures may still be taken for the permanent cure of the condition which leads to the perforation.

Chronic conditions usually precede perforation and give ample warning of their presence before it takes place. While this is accepted, so far as the appendix is concerned, it has not been so generally recognized that gall stones are foreign bodies which need only infection to lead to the most widespread peritonitis, cholangitis, biliary cirrhosis and pancreatitis.

Chronic ulcers of the stomach and duodenum, after a reasonable attempt has been made at medical cure, should be looked on as surgical maladies.

Details are furnished by A. E. Chisholm[3] of 2 cases of *peritonitis following a non-penetrating wound* of the abdominal wall: (1) A soldier recently injured was

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(2) Surg., Gynecol. and Obstet., January, 1919.
(3) Lancet, July 12. 1919.

admitted Oct. 2. The entrance was in r. buttock just outside post. sup. spine, exit in lateral sector of r. iliac region. Ant. wound opened up and no penetration of abdomen found. Death in two days. Necropsy disclosed peritonitis involving chiefly lower half of small bowel, pelvis and cecal region. No free gas. The parietal peritoneum was carefully examined and no perforation found, small and large bowels also intact. It would seem the intraperitoneal infection must have taken place in one of three ways: 1. By direct spread from the wound through damaged parietal peritoneum. No swab taken from wound, but the day after operation it looked fairly clean. 2. By escape of infection through a perforation in the bowel. But one has good reason that no such perforation existed. 3. By escape of infection through contused bowel. The absence of fecal odor in the exudate tends to negative this. The probability is the infection spread from the wound.

II. Soldier wounded Feb. 27; operation some 12 hours later. Entrance wound on r. iliac crest anteriorly. No exit wound. Severe fracturing of ilium and a good deal of laceration of iliacus muscle. Peritoneum exposed in track but not lacerated. Patient was greatly shocked and had apparently lost a good deal of blood. Operation consisted in cleaning up the wound and clipping away as much damaged tissue as was deemed wise, considering the poor state. The parietal peritoneum was left intact. The wound was bipped and left open. Post mortem: Peritonitis with signs of bruising of bowel, but no perforation either of bowel or peritoneum.

Ileocecal catheter drainage of bowel in diffuse peritonitis is recommended by H. C. Cooney.[4] For over 2 years as a routine prophylactic he has passed a No. 9 rubber catheter through the appendix or if impossible through a small stab in cecum, invaginating the orifice by a catgut circular suture, tacking the cecum to peritoneum by another catgut suture, attaching the end of omentum around catheter to cecal wall, draining abdomen, and putting in high Fowler position. One-half pint of saline or tepid water is introduced, catheter clamped for 2½ hours, then allowed to drain into a

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(4) Minnesota Med., September, 1919.

bottle for 30 min. This is strictly kept up for 5 to 6 days. Should there be much abdominal distension, after 24 hours he injects 4 to 6 oz. of Pluto water through the catheter and repeats if necessary every 12 hours until the bowels act. The bowels usually move spontaneously, or, if not, an enema in 24 or 48 hours after operation is given, no valuable time is lost, the catheter begins to drain gas and often fecal material while patient is still on table. The patients, now 22 in number, and all in critical condition with diffuse septic peritonitis, upon whom he carried out this procedure, have all recovered, excepting 2 who died in few hours.

The fistula, if indeed any such remains after the removal of the catheter closes in a few days; a catheter draining through the appendix stump into the colon at operation insures against loss of valuable time, secures drainage of the small bowel and colon and provides a certain method of enteroclysis which must be absorbed and not rejected as is often the case with proctoclysis. Saline cathartics in his judgment, should be used through the catheter to stimulate peristalsis (high authority to the contrary notwithstanding), if the bowels do not act in 48 hours. A double drainage tube is placed in the cul-de-sac of Douglas through a suprapubic stab and all intestinal adhesions are freed quickly, so the pus and septic fluid in abdomen will fall into the pelvis in one pool. The patient is kept in exaggerated Fowler position for 3 or 4 days, sometimes longer, during which time only water and tea are given by mouth. If vomiting occurs the stomach is washed out. As soon as these patients are safe, they develop hunger and he waits for that.

The *treatment of peritonitis* presented by G. W. Crile[5] is based on a total experience of himself and colleagues, of 13,415 laparotomies. By the general management outlined, their mortality in all abdominal operations has been decreased 33.3 per cent.; in acute appendix operations alone, the reduction has been 67.6%

The prime problem of abdominal infection is the same as the prime problem of abdominal surgery in general —the reduced resistance and mounting acidosis. These

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(5) Jour. Amer. Med. Ass'n, Nov. 29, 1919.

point the way to the two prime requisites in treatment: (1) Conservation of the remaining energy against further depletion, and (2) the neutralization and elimination of the superabundant waste products. In the abdominal case in which immediate operation is not imperative, the vitality may be increased by obvious measures—diet, fresh air, and above all *rest and sleep,* until a favorable condition for operation is obtained.

As for the technic of the operation, whether it be performed in one or two stages, whether it be the removal of an appendix or gallbladder, resection of the stomach or colon, or, in the wounded soldier, the repair of intestinal perforations, every step should be under complete anociation—gentle manipulations and sharp dissection.

1. Nitrous oxid-oxygen.
2. Anesthetized incision.
3. Accurate, clean-cut operation to diminish both infection and shock.
4. Adequate drainage.
5. Fowler's posture.
6. Vast hot packs over the entire abdomen, spreading well down over the sides.
7. Five per cent. sodium bicarbonate, with 5 per cent. glucose by rectal tap, continued as long as it is tolerated.
8. Primary lavage of the stomach, repeated only if indicated. (It will rarely be indicated if anociation is complete.)
9. From 2,500 to 3,000 c.c. of physiologic sodium chlorid solution subcutaneously every 24 hours until danger is past.
10. Morphin hypodermically until the respiratory rate is reduced to from 10 to 14, and held to this until danger is past. It should be noted, however, that morphin is not useful in a streptocococcus peritonitis.

By employing water, hot packs, and morphin, the surgeon can play the patient almost at will. The control of the drive, as marked by the changes in the respiratory rate in particular, is dramatic. Morphin lowers the respiratory rate, decreases the peristalsis of the intestines, reduces pain and secures physiologic rest and sleep, the prime means of recuperation.

Under this combination, Crile and associate have performed 409 consecutive operations for acute appendicitis with- or without generalized peritonitis without a death.

Mesentery. C. F. M. Saint[7] had occasion to operate successfully on a patient, of 38, for obstruction due to a *multilocular mesenteric cyst.* Shortly after last childbirth, 4 months previous, had severe pain with vomiting. The abdomen was tender, and she discovered a mass in cavity. Since then recurrent attacks, no change in mass. On palpation, the tumor was size of cocoanut, firm, and more or less rounded. Movable, though not especially, and could not be pushed into pelvis; no connection with uterus to be made out. Percussion showed no free fluid, and only limited impaired resonance over growth itself. The diagnosis was ovarian cyst (probably dermoid) based on history and findings. At operation the tumor was found to be situated in mesentery of lower jejunum, and the corresponding part of the small gut was stretched and flattened out as it passed over it. The intestine above was markedly hypertrophied and somewhat distended, below was collapsed. It was impossible to shell out the cyst, and to remove it, it was necessary to excise 30 in. of gut. The divided ends were then closed and lateral anastomosis performed.

Sarcoma of the mesentery is uncommon, and the details of a case given by A. Guaccero[8] are valuable: A woman, of 38, for some 5 years previous had had abdominal crises of pain principally in r. iliac fossa, generally subsiding after hot compresses. Went through childbirth in the first year of these attacks, but lactation was interrupted by a more violent crisis, this time accompanied by vomiting. During a second pregnancy, the pain became more marked, and abortion occurred at 4th month. After this pain became constant with paroxysmal crises. About a year before the woman discovered a mass in r. iliac fossa, this was round, smooth, tense, dull on percussion; and movable could be pushed up to umbilicus. Not connected with uterus. Laparotomy disclosed a growth, size of child's head, implanted by a short pedicle between the layers of the mesentery near the valve. Operative recovery. The mass had a tough capsule, and was of the small round-cell type.

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(7) Edinburgh Med. Jour., June, 1919.

(8) Il Morgagni, April 30, 1919.

Omentum. A. Aimes[9] makes a general review of *torsion of the omentum.* A portion of the great omentum increased in weight by fatty infiltration, by epiploitis, or presence of a tumor, becomes pedicled. Under the influence of ill-known causes, this pedicle may undergo rotation (partial torsion); such torsion may involve an epiplocele in a hernial sac (intrahernial or intrasaccular). On the other hand, the whole omentum may turn about 2 fixed points, *e. g.*, its colic insertion and some adherent point (complete- or abdominal torsion). There may also be a torsion *en masse,* both abdominal and intrasaccular; or complex torsions. These last are associated with tumors of the omentum, with other lesions—appendicitis, twisted pedicles of ovarian cysts, twisting of inflammatory deposits, etc.

Only 25% of patients are females. The average age is 45, with extremes of 54 months, and 79 years.

Of the predisposing causes, 72% are in subjects with hernia, this is generally on r., and nearly always an old epiplocele. On 2 occasions, however, there was a parietal hernia. Another cause is epiploitis; also neoplasms involving the omentum. Of the determining causes direct trauma has been alleged; most patients attribute it to some exertion. Lejars insists on repeated taxis and ill-fitting trusses. Morestin has published a case following purgation.

[See also De Courcy's case.—Ed.]

As regards the pathogeny, the 2 classes are:

(A) *With hernia.*—Granted that some effort, coughing, taxis, trauma, may set up torsion, how are we to account for it when occurring in patients in bed for many days? As for torsion of all other organs. several hypotheses have been formulated: Tendency to rotation (Jaboulay). Owing to the incessant motion of the omentum, there is a constant tendency to rotation. This is readily seen during the radical cure of an epiplocele when we note a true overriding of the lobules massed and imbricated on each other, so much so we are obliged to separate them that they can be ligated. To this Foussenq objects it is difficult to explain torsion of an absolutely normal omentum, which is far too mobile to

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(9) Progrès Méd., Oct. 25, 1919.

roll up, and this apron, as it were, floats in front of the coils of bowel, but does not roll up; though, torsion is possible if there is epiploitis. Lejars asserts by the presence of the nodules of epiploitis, predisposed to torsion of themselves, the omentum is drawn out especially by taxis; to this must be added sudden increase in size of the omental mass, so soon as the twist begins, there is congestion of the omentum, an increased size, which in turn leads to a new twist and so on.

Action of peristalsis (Bazy) Morestin's case just cited, is in favor of this theory. The vascular theory (Payr). This view, based on animal experiments, attributes the torsion to venous stasis and to an unequal development of the swellings. After masses of magnesium were inserted in the omentum of animals, the hydrogen given off caused small swellings, true cysts of unequal development, hence torsion by displacement of the centre of gravity. The arrangement of the vessels also sets up circulatory disturbances. The arteries are more resisting the veins are elastic and joined closely, if a stasis is produced, the veins turn around the arteries, for being longer and more sinuous, they hold more blood. In 8 experiments, Payr obtained total volvulus in 4 by partial ligation of the omentum, preserving the vessels but inserting a kidney in the lower edge, stasis was then set up by a few ligatures of the veins.

(B) *Without hernia.*—The twist may be secondary to torsion of a tumor attached to the omentum or to some adhesion. As to primary torsions, some authors deny the occurrence of this type. Riedel considers them as consecutive to old hernias in which the omentum becomes freed. Lejars admits that the omentum can twist like other abdominal organs but believes inflammation is the cause. Schoenholzer calls attention to the influence of chronic appendicitis, which in turn sets up epiploitis, he is even astonished that torsion is not more frequent considering how common chronic appendicitis is. So far as the complex twists are concerned, Lucas-Championnière observes that we can readily understand the twisting of a pedicled and mobile organ, but not why one fixed on all sides becomes twisted.

Appendicitis is the affection most often confused with this torsion. The same sudden onset after successive crises, frequent location of torsion in r. iliac fossa, doughy swelling, etc. But, says Lejars, the swelling is too large to have developed quickly, in view of the recent development one suspects a large abscess, yet in torsion the temperature is not very high, the pulse is not rapid as would be expected with a large purulent collection, and there is no severe vomiting. There is little change in the general state. The pain is not exactly at McBurney's point. The swelling is more regularly rounded, more superficial, closer to the wall than the appendicular one. In spite of these theoretical differences, Aimes points out, the differential diagnosis is extremely difficult. Broca has added another useful sign: The swelling has no induration around it, while with an appendicular abscess of this size, doughiness is obligatory.

The symptomatology of all torsions being the same, we may suspect torsion of an ovarian cyst. In one case, Broca writes that the symptoms were so identical he would have made this diagnosis, save for the sex. Hedley also noticed a similar instance. The difficulty is increased when both these types of torsion coexist (Payr's case), or when the extravasation following the torsion simulates a cyst, in Dujarier's case, the size of a child's head. A pedicled fibroma may give rise to the same error, as in Lance's case, if subject to crises of torsion. Intestinal obstruction can be ruled out, because the arrest of flatus and feces is rarely total, there is subocclusion.

Torsion has also been mistaken for typhlitis, volvulus, intussusception, tuberculoma of cecum, strangulation of ectopic testis, cholecystitis, vesical hernia. Most of these cases were helped by the error of diagnosis, for the patients were operated on immediately.

The sole treatment is surgical, and this should be rather early to guard against gangrene of the twisted portion. As Lejars writes, we never regret operating too soon, always finding once the abdomen is opened, that the lesions are much greater than had been imagined. Free exposure must be made to avoid overlooking a torsion high up. Simple untwisting is not enough, the whole area involved must be resected, this is often profoundly affected either from the chronic epiploitis or the recent gangrene. Careful exploration of the abdomen is necessary to discover coexisting—and possibly—causal conditions, cysts, appendicitis, omental neoplasms, etc. In timely operations the mortality is practically *nil.*

J. L. De Courcy[1] came across an example of *twisting of the whole great omentum* at the transverse colon without apparent cause, and finds no similar case on record recently: A man, of 37, was referred with a tentative diagnosis of acute appendicitis. He had 3 attacks of cramps during the past year, which were relieved in 12 to 24 hours by castor oil. During the year he had suffered from so-called indigestion and took a cathartic every night. The onset began about 24 hours before entrance, by severe pain about umbilicus. Temperature, at hospital, was 98, pulse 60 and respirations 18. Examination of his abdomen revealed no distension and no signs except a slight rigidity of r. rectus and tenderness over r. lower abdomen. A right rectus incision made as for appendicitis. When the peritoneum was reached it could be seen there was blood underneath, giving the appearance frequent in a ruptured ectopic. On opening peritoneum dark blood immediately escaped and gangrenous omentum presented itself. The incision was immediately enlarged up. It was then seen the entire great omentum was gangrenous and twisted about 5 times at the transverse colon. The transverse colon was not twisted itself, but the omentum had torn itself loose from its splenic portion, thus accounting for the hemorrhage. The large and small bowel was apparently normal in every respect and the appendix was normal; no hernia. One significant point was the omentum had overlapped itself from left to right, *i. e.*, from spleen towards liver, so its splenic attachment had been torn loose. In trying to account for this condition De Courcy could find no basis other than his repeated catharsis.

Two interesting cases are recounted by G. A. Syme:[2] *(I) Omentum adherent to leaking malignant ulcer of stomach.* Woman, aged 52, seen in consultation, had been treated for 4 years for "indigestion." A few days previously had had pain in l. side, and herself discovered a

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(1) Annals of Surg., April. 1919.
(2) Med. Jour. Australia, Nov. 2, 1918.

lump, which was tender; no vomiting and no other symptoms. On examination a hard mass, the size of a small tangerine, could be felt in region of the umbilicus, extending somewhat to r. It was rather tender, moved with respiration and was movable laterally. A screen examination after an opaque meal showed the stomach large and low, with delayed emptying, and reversed peristalsis in the duodenum. On opening abdomen omentum found adherent to the ant. wall of stomach and also to parietes. On separating the adhesions an open ulcer was exposed, about .5 in. wide with thickened edges in stomach towards the greater curvature. The ant. wall was widely resected, with the glands in the great omentum, and the gap closed. Both the ulcer and glands were endotheliomatous. (Later extensive recurrence took place in the glands.)

(II) Torsion of omentum adherent to healthy stomach. An adult female had been in perfect health until 14 days before, when she had pain and a feeling of heaviness in the abdomen. Two days later noticed a lump in l. side, which was tender. It had not altered in size. No vomiting or other symptoms, and had not lost weight. On admission T. was 99.4° and P. 104. The abdomen was soft, moving well with respiration. There was a swelling, somewhat sausage-shaped, about 3 in. in its longest direction, hard and freely movable in all directions. A screen examination showed the mass was aparently in the stomach wall, moving with it, and there was a suspicion of a "filling defect." At operation the lump proved to be thickened omentum, adherent to the ant. surface of stomach. The omentum was twisted 5 times. The twisted portion was ligated with cat gut and removed. No other pathologic condition; uninterrupted recovery.

THE STOMACH AND DUODENUM.

Stewart and Barber[3] treat of *gastric hypermotility.* They state for 8 years previous, the records of chronic cholecystitis, with or without cholelithiasis, duodenal ulcer, and chronic appendicitis bearing x-ray notes on

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(3) Jour. Amer. Med. Ass'n, Dec. 13, 1919.

the motor function and verified by operation, disclose gastric hypermotility for gallbladder disease in 68.4 per cent., for duodenal ulcer in 75, and for chronic appendicitis in 55 per cent. of cases. Experiments purposely carried out in the open surgical abdomen antedating this clinical review give hypermotility for gallbladder disease in 61.5 per cent., for duodenal trauma in 66.7, and for appendix disease in 100 per cent. of experiments. The motor characteristics of surgical lesions of the stomach are the incisura, and pylorospasm (pyloric-sphincter-spasm) in that they probably more frequently occur in the presence of essential disease. Diffuse pylorospasm appears very often "reflexly."

[See also Acute Dilatation of Stomach.—Ed.]

A. Schwyzer[4] records his *late-results in stomach surgery.* The affections were: Carcinoma of the stomach, 26 with 1 death. Ulcers, including strictures of pylorus, 76 with 1 death. Acute perforations of ulcers, 15 with 4 deaths. Ptosis and dilatation without definite stricture, 13 with no deaths. Unclassified, mostly indistinct indications, 9 with 2 deaths. Total: 139 cases with 8 deaths.

Eighty-six gastroenterostomies, with 2 deaths, 2⅓%. Thirteen pyloroplasties (Finney), with 1 death, 8%. Thirteen gastroplications (partly with other op.), with no deaths, 0%. Twenty resections, with 1 death, 5%.

Leaving aside all the cases which were observed for less than a year after operation, we have, including the carcinomata, recent reports from 91. Of these are well, 62; greatly improved, 12; improved, 15; temporarily improved, 2. When we consider only those observed 2 years or longer, reports from 72. Of these are well, 49; greatly improved, 12; improved, 11. Of the 47 cases observed 5 years or over, reported as well today, 31; greatly improved, 9; improved, 7. Ten cases were observed over 12 years. Today, well, 8; greatly improved, 1; improved, 1.

After looking up 106 discharged non-malignant cases, there were 9 from whom he had no end-result information. Thus 97 could be traced. Among these, only 3 subsequently died. These deaths were at least in 2 instances not connected with the stomach condition. Schwyzer's study comprises 14½ years and many pa-

(4) Minnesota Med., April, 1919.

tients were of advanced age. The impression thus had to be that these patients had a very good average resistance, even if the untraced cases are considered as suspicious. The often-heard objection, that these stomach patients even after a technically correct operation are reduced in their power of resistance, is a myth.

Furthermore, investigations like these would indicate the patient who is completely relieved of his symptoms for a year after operation most always stays cured.

[In my experience the late-results in all operations upon the stomach are very satisfactory, with few exceptions, since giving the patients carefully-prepared printed directions for their diet, because a large proportion of such patients are likely to return to their bad-habits of eating all kinds of foods, which cause irritation of the stomach unless carefully instructed.—Ed.]

Polya Operation. In this method the jejunal loop is brought up through a slit in the mesocolon. By this means freedom of action is secured. At the conclusion of the anastomotic suture, the stump of stomach is drawn down through the mesocolon, and the edges of the mesocolon secured to it. If a high resection is performed, this latter stage may present serious difficulties. In such cases the small bowel should be brought up in front of the transverse colon, and the anastomosis with the jejunum performed 15 to 18 in. from its origin. By this method (Balfour) the death rate has been very greatly reduced. When Polya published his article in 1911, he had tried his method in 6 cases. Three died within 24 to 48 hours after operation; and a fourth, from erysipelas and duodenal fistula, on 49th day. Two left cured.

E. M. von Eberts[5] in 3 cases followed Polya's original procedure in each instance. In none did vomiting occur after operation, and all patients left free from symptoms.

J. T. Mason[6] *performed 15 operations* in 4 years. Polya's claims for this operation, which are important, are: (1) The gastroenterostomy is easily made. (2) The stump can be easily united with the intestine without any tension. (3) The suture is absolutely safe, as everywhere there is a bloody serous surface in approximation.

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(5) Canada Med. Ass'n Journal, December, 1918.
(6) Northwest Med., April, 1919.

The conditions of the emptying of the stomach are as safe as possible because (*a*) the communication is very broad; (*b*) the opening is at the distal portion of the stomach, also in the same direction which corresponds with the physiologic emptying of the stomach; (*c*) the stomach empties in the upper jejunum and therefore it is in the afferent loop.

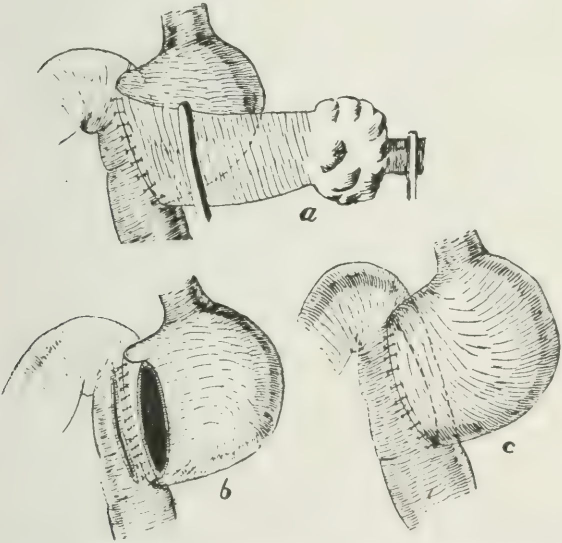

Fig. 121. Anastomosis between severed end of stomach and side of duodenum—from original cuts of Polya (Mason).

The technic varies with the location of the disease. When near the pylorus the stomach side should be severed first. The gastroduodenal artery is approached from behind and easily controlled, which is not true if one severs the duodenal side first. Should the growth be on the lesser curvature, not too close upon the pylorus, the duodenum is severed first, and the severed end of the duodenum and stomach cauterized. The crushing clamps of Payr are used on both sides. Mason does not feel it is safe to anastomose the jejunum into the stomach before the carcinomatous area has been removed as suggested by

Polya. Although the technic is easier, one runs a chance of having the field soiled by a rupture of the stomach wall and also the certainty of spilling cancer cells, unless one is very cautious. The enfolding of the duodenum must be very secure. Four of his cases have had the duodenum open on 3d and 4th day. The complications were technical; none of them died from shock. In fact, those who had no technical complication had a recovery as uneventful as following subacute appendicitis.

Pyloroplasty. *A new technic* is introduced by J. S. Horsley.[7] The steps are:

1. The upper duodenum and pyloric end of stomach are exposed through an ample incision, and a point is selected in midline of the ant. surface of the duodenum 1 in. from pylorus, and another point on stomach not less than 2 in. from pylorus and midway between the curvatures. Each of these points is grasped with Allis forceps or fixed with a suture. The stomach and duodenum are then surrounded with moist gauze. 2. An incision is made with a sharp knife from the point on duodenum to point on stomach. If the ulcer is in ant. surface of duodenum, the incision should pass along the lower edge of the ulcer. An effort is made to divide the peritoneal and muscular coats without opening mucosa. The incision should go no farther than 1 in. into the duodenum. It extends 2 in. or more into the stomach. The bleeding points or exposed vessels are clamped. 3. The mucosa is incised and any further bleeding points are clamped, care being taken to include as little of the mucosa in the grasp of the forceps as possible. The vessels are tied with catgut. If there is a tendency for duodenal contents to regurgitate, gauze wrung out of warm saline is gently packed into duodenum. Moist gauze can also be placed in stomach if necessary. If the ulcer is along incision, it is excised from mucous surface and the forceps, scissors, and knife used in the excision are laid aside. Because the mucosa here is almost free from bacteria except in the ulcer, there is no occasion to disinfect the normal mucosa.

4. If the ulcer is in post. wall of duodenum or pylorus, the wound is retracted, the ulcer exposed and excised, the

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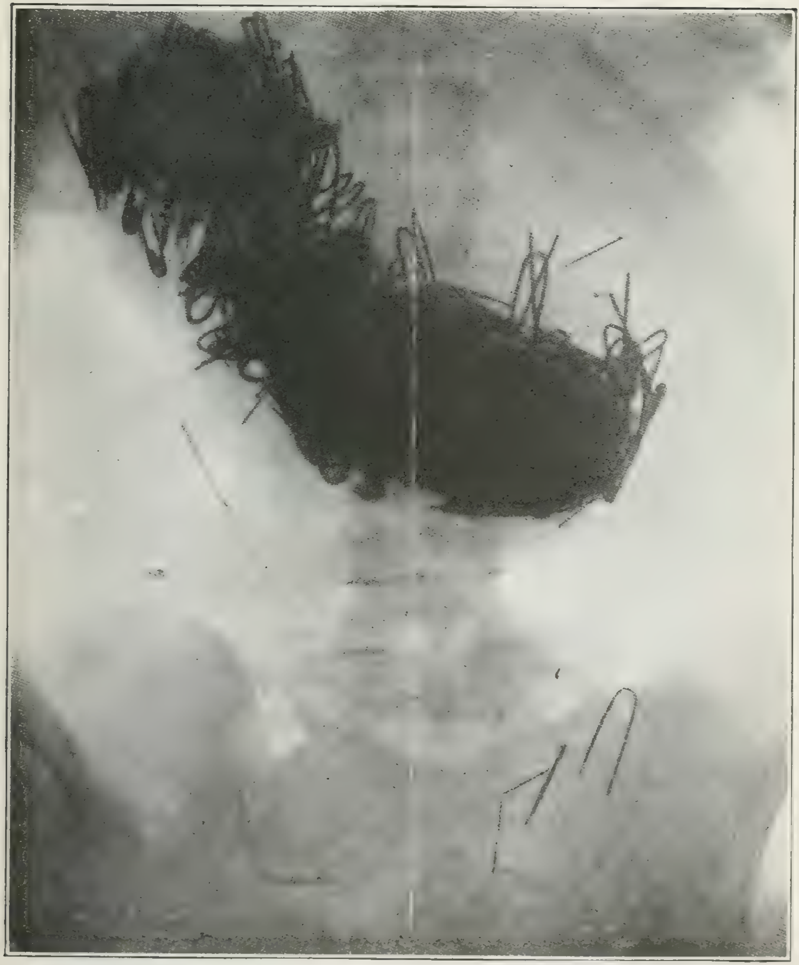
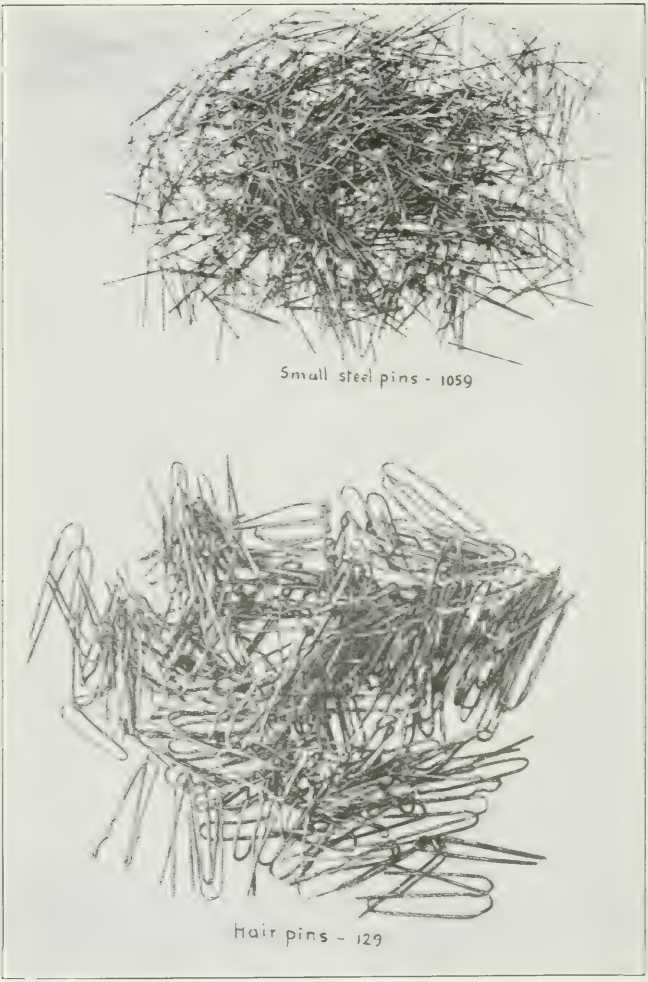
(7) Jour. Amer. Med. Ass'n, Aug. 23, 1919.

PLATE XVIII.



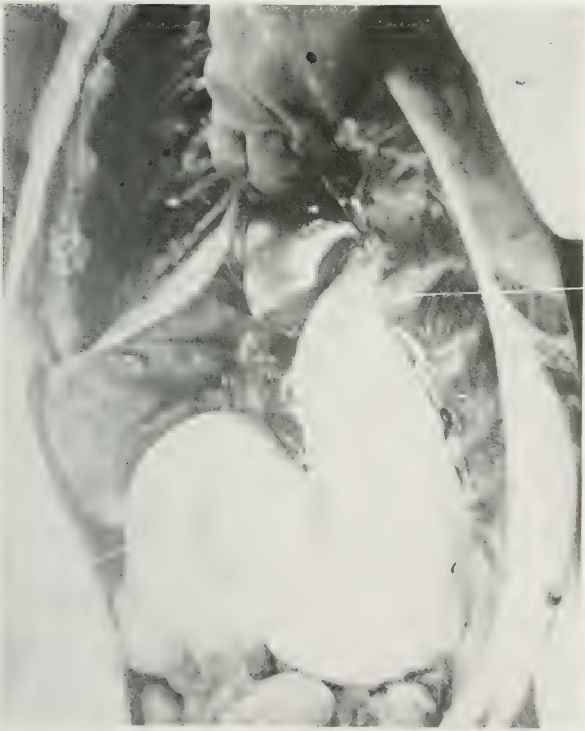
Roentgenogram showing foreign bodies in stomach before operation.—Winslow. (See p. 379.)

PLATE XIX.



Same. Objects photographed after removal from stomach.—Winslow. (See p. 379.)

PLATE XX.



Acute dilatation of stomach. Showing tremendous enlargement of stomach and duodenum.—Harrigan. (See p. 381.)

deeper structures are sutured with tanned or chromic gut, and mucosa gently approximated by a continuous suture. The suture in the mucosa must not be tight, as this might cause necrosis of the mucosa and spread the ulcer. If there is an old contraction resulting in pockets, the mucosa and the contracting band should be divided and mucosa sutured transversely to incision. To avoid hemorrhage, the incision of contracting band should be short and should divide only the superficial part of band. 5. The ulcer having been removed or pockets and contractions remedied, the ends of the incision are approximated by a tanned or chromic gut suture. A second suture of similar material placed half way between this middle suture and the upper angle of the wound renders suturing the upper half of incision easier. Both are tied and their ends left long to facilitate suturing and to hold up the edges if there is a tendency of gastric or duodenal contents to overflow. A No. 1 tanned or chromic gut suture is then started at the lowest portion of the wound, *which is in the stomach wall.* It is tied, the short end clamped, and mucosa united by a lock stitch which barely approximates the mucosa and ends at the upper portion of the incision, *which is also in the stomach wall.* Before completing this suture any gauze packing is removed. The suture is tied at the upper portion of the wound and the ends are left long and clamped.

6. A second row of sutures, of the same kind of gut, in a curved round needle, is inserted, taking in the muscular coat. This is a continuous mattress or right-angle stitch. Only enough tissue is included to secure a firm hold. The long ends of the previous row are cut short.

7. A third row of sutures of fine tanned or chromic gut is placed, but the gauze around the stomach and duodenum should be removed before this third row is begun, as gauze hinders approximation of the peritoneum. This row includes the peritoneum and muscular coats and buries the first and second rows of sutures completely. This is also a continuous mattress suture. 8. A portion of the gastrocolic omentum, or else r. edge of great omentum, can be brought up over line of incision without tension. It is fastened here with interrupted stitches of fine gut. Care should be taken that it barely covers the

upper end of the sutured wound and is not fastened to the gastrohepatic omentum, as this might result in too complete a surrounding of the pyloric end. 9. If the ulcer is not in duodenum or pyloric region, the operation, as just described, may be done to relieve the spasm of the pylorus and the ulcer then excised, or cauterized (Balfour) through another gastric incision.

A. J. Ochsner, in the discussion, wished to direct attention to a faulty premise which is introduced into every discussion of this subject. In experiments by Cannon and Blake the stomach of healthy animals had the form needed to do its physiologic work. It is the business of the stomach to store a certain amount of food in one portion, grind it in another portion and deliver it through a normal pylorus. The diseased stomachs which we consider in these discussions have an accumulation of connective tissue and an obstruction in the region of the pylorus which produces an entirely different machine. When we make a gastroenterostomy we permit the residual decomposed material to pass out of the pouch in stomach into the duodenum. The conditions are entirely different from those in a normal stomach which could take care of its contents in a normal way. After that has happened, because there could no longer exist a quantity of residual material and we have given the muscula-

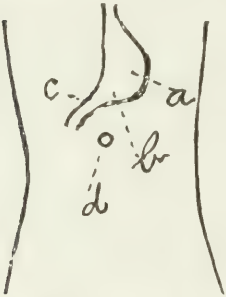


Fig. 122. *a*, gastric pouch; *b*, pylorus; *c*, duodenum; *d*, umbilicus The stomach outlet is at the lowest point in a normal stomach.

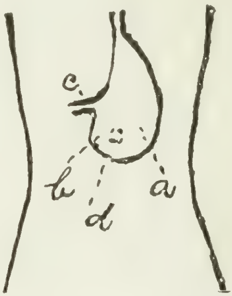


Fig. 123. The position of these points is altered in the dilated stomach; hence the gastroenterostomy opening is made between *a* and *b* (Ochsner).

ture time to resume its physiologic work, we make our observations again and find that the stomach walls are again doing their physiologic function in the old way.

Wounds and Foreign Bodies. In a man, of 41, seen by C. C. Booth,[9] the *entire stomach herniated through a stab-wound,* 1.5 in. long, the strangulated mass measured 10 in. wide. The skin was painted with 5 per cent. iodin beneath the tumor to the edges of the wound, after which the tumor was thoroughly cleansed with saline. The tumor consisted simply of the entire stomach, and the stab wound was 1½ just beneath the ensiform the wound severing the rectus on both sides of midline. The stomach was gradually reduced, wound cleansed with iodin, and wound layers sutured, the wound being entirely closed. Healing delayed by a stitch-abscess.

A *fork in stomach and duodenum* was extracted by K. A. Lees.[1] A woman, of 25, had lost all the upper teeth, on Christmas day she swallowed a piece of giblet. During an attack of vomiting this stuck in gullet, and trying to dislodge it with the fork this slipped from her grasp. As usual, her story was not believed, and owing to the holiday, no x-ray could be had for over a day. This showed the prongs at cardia, handle at pylorus. Immediate gastrotomy, and the fork 6.5 in. long removed, the handle being in duodenum. Uneventful recovery.

A woman, aged 34, had *1290 foreign bodies removed from the stomach,* by R. Winslow.[2] This is believed to be the largest number ever extracted during life, though Vandivert and Mills (1912 volume, p. 392), found 1446 at necropsy. These were: Straight pins, 1059; safety pins, 45; hair pins, 129; pieces of bone hair pins, 9; pieces of wire, 36; buttons, 6; iron screw staple, 1; iron hook, 1; wire nail, 1; paper clamp, 1; garter buckle, 1; breast pin, 1. Besides these the skiagraph showed 10 pins and hair pins in the intestines, but at the time of her discharge all but 3 or 4 of these had passed naturally. The grand total of foreign bodies in stomach and intestines on admission as shown by the x-ray and by removal was 1300, most of them sharp-pointed objects liable to

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(9) Jour. Amer. Med. Ass'n, March 29, 1919.
(1) Lancet, Feb. 22, 1919.
(2) Annals of Surg., July, 1919.

perforate the viscera; that they did not do so is surprising. It must have taken a long time for her to secure so many articles, especially as she had been detained in a hospital for the insane, where she would have been under constant observation, 18 months. (Plates XVIII, XIX.)

Phlegmonous Gastritis. A series of *17 cases* is tabulated by H. Sundberg[3] with 198 from the literature. The inflammatory process develops mainly in the submucosa. Hedenius was the first to suggest the infectious origin (1871); streptococci have been demonstrated in 71 of 95 cases examined. In only 8 per cent. of all the cases listed were the patients of the well-to-do class; 25 per cent. had been hard drinkers. In the 17 personally observed cases, there was always a history of chronic gastritis, and the secretion of gastric juice was abnormally low. The inflamed mucosa is peculiarly vulnerable, and the deficient gastric secretion leaves it defenseless. Infection can occur by direct implantation of germs or by way of the blood. Pus in the vomit is the most instructive sign of the affection, especially when the amount is large and the intervals short. Another instructive sign is that the pains which may come to resemble those of a perforating gastric ulcer subside when the patient sits up after reclining. This was constant in his cases, and the high fever also testified against perforating gastric ulcer. In 33 per cent. of the fatal cases nothing was found to indicate peritonitis. Rational treatment can be only by resection of the diseased portion but spontaneous recoveries are known. Cases in which after an exploratory incision revealing supposedly incurable cancers, the patients survived for years afterward, may have been cases of phlegmonous gastritis on the road to healing. The death rate in his nonoperative series was 92 per cent. Cases in men are nearly three times more numerous than in women. The ages were between 20 and 60. High fever and general malaise, headache and thirst, with vomiting and sometimes persistent hiccup often usher in the disease.

[For other cases see 1918 volume, p. 395, and 1919 volume, p. 394.—Ed.]

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(3) Nord. Med. Arkiv (quoted in Jour. Amer. Med. Ass'n, Sept. 6, 1919).

Acute Dilatation of Stomach. Three examples of this, one due to an unusual cause, plating of a fractured femur, came under the notice of A. H. Harrigan.[4] The plate was applied Jan. 15, and the wound became infected. Feb. 17, the plate was removed. Vomiting began March 9, and continued till death on 15th, despite lavage and all other measures.

It is interesting to recall the actual conditions preceding this lesion. In a patient suffering from an infected wound, of moderate severity, acute dilatation develops to an extreme degree. Profound toxemia occurs and death. But many days had elapsed since the anesthetic. It is impossible to ascribe this case to the excretion of ether or chloroform into stomach. The sole etiologic fact is the rapid acute dilatation following placing on a Bradford frame. This incident, which would place this case in the category described by numerous authors, as following scoliosis, kyphosis, etc., is strikingly similar to one where acute dilatation developed, following application of a plaster jacket with scoliosis. The sliding of the patient, with the buttocks projecting into the opening in canvas, produced a marked bending of spine. The alteration in posture, merely offers, as it were, a mechanical preparation. The specific causal element is, no doubt, more profound and physiologic.

The other 2 cases were of an entirely different nature: (II) At conclusion of a Gilliam suspension, which had proceeded smoothly, he noticed the stomach bulging into the wound. The incision was about 4 in. long and midway between pubis and umbilicus. The stomach was intensely engorged. To the hand it felt like a large cyst and appeared to be at least five times its normal size. The greater curvature, when stomach was at maximum distention, was but 4 in. from pubis. The stomach rapidly returned to normal size by introduction of a stomach tube. At no time during the operation was the swallowing of air detected. This point was corroborated by the anesthetist. (III) During an operation for chronic appendicitis and salpingitis the stomach presented into the wound. At the time of maximum distention, the greater curvature measured 2 in. from pubis. Nothing note-

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(4) Annals of Surg., May, 1919.

worthy occurred, save that during the induction of narcosis, the patient became cyanosed and tongue was forcibly pulled forward. (Plate XX.)

In conclusion Harrigan points out there is in both stomach and duodenum an intrinsic nervous system which for the sake of simplicity is called "the myenteric plexus." In various places it forms distinct nodes. This nodal system is supposedly the point where the impulses leading to peristalsis are initiated. At present there is no direct evidence to prove that marked alterations occur in the myenteric plexus as the result, or coincident with duodenal obstruction. A marked disadvantage lies in the absence of a technical measure which can actually reproduce acute dilatation. Moreover, the animals best suited to these experiments, *e. g.*, cat and dog, offer peculiar difficulties to the histologist in his efforts to secure suitable specimens for microscopic study of the myenteric plexus. From the standpoint of the histologist, the white rat is, perhaps, the best animal; but, for the experimental worker, is particularly unsuitable for experimental operation. The finding of anatomic alterations in the myenteric plexus would prove of value, that would practically constitute direct proof that the theories of Keith, regarding the nodal system, possessed a sound basis.

In the case met with by J. E. Gilcreest[5] the dilatation as usual followed an abdominal operation: Appendectomy was done on a man, of 35. On the morning of fourth day, he began vomiting, recovery followed repeated lavage, and Gilcreest believes if this had been carried out more frequently, would have been quicker.

[It has been found of great value to have a standing order which directs the use of gastric lavage in all cases of postoperative distension of stomach or intestines, with water at 105° to 110° F., as soon as condition is discovered by nurse, who should be instructed to observe the patient with a view to discover distension at its beginning.—Ed.]

Lake and Kevin[6] detail a case of *"acute idiopathic dilatation,"* in a man, aged 25. The day previous to admission after dinner he was seized with a sudden pain in

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(5) Southwest Jour. Med. and Surg., May, 1919.
(6) Lancet, July 5, 1919.

epigastrium and shortly afterwards vomited. The case was not thought serious until the following morning, when he began to develop signs of peritonitis. No gastric history. Upon admission he was continuously vomiting large quantities of slightly blood-stained material containing undigested food from previous day. The abdomen was considerably distended, but quite rigid.

Operation at once, peritoneal cavity contained a large quantity of blood-stained, thin, purulent fluid. The stomach enormously distended, occupying the greater portion of abdomen; small intestine collapsed and pushed well down into pelvis. Stomach wall was thin and in places hemorrhagic; no perforation found. A gastrostomy was performed (Kader) and several pints of stomach contents were drained off. The gastrostomy tube drained large quantities of increasingly blood-stained material. Death 17 hours after operation. Necropsy—the stomach was smaller than at operation, but its walls were so thin in places as to be quite transparent. The mucosa for the most part was deeply hemorrhagic. The distension involved 1st and 2d portions of duodenum; otherwise intestines were normal. No perforation or stricture.

There are two possibilities: 1. That peritonitis is the primary cause and dilatation a secondary paralytic one. 2. That dilatation is primary and peritonitis due to migration of organisms through the attenuated stomach wall. The man had been eating salted herrings; large masses of the sharp spines were found in cecum, the spines so sharp as to perforate the bowel on the slightest pressure. The suggestion arises that infection may have been carried through in this manner, but the peritoneum usually deals very effectively with small infections of this nature. The case must, therefore, be left as "idiopathic."

As regards *gas and the motility of the surgical stomach*, W. H. Barber[7] concludes atmospheric air serves as a basis for stomach gas. Gastric air tends to preserve normal intragastric tension at which the stomach contracts most effectually but above and below which the contractions fall off. Spontaneous rupture of the normal stomach is probably unknown. In dilated stomach the gas accumulates in abnormal amounts and correspond-

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(7) Annals of Surg., March 1919.

ingly influences gastric peristalsis. The cause of chronically disturbed stomachs may lie in diseased appendices, gall-bladders, duodeni, or in other organs. Diseases of the stomach, appendix, gall-bladder, and duodenum may be associated with gastric hypermotility and pylorospasm. Contractions of the stomach and of the intestine occur, under certain conditions, in the open surgical abdomen and appear to be influenced by parietal and visceral traumata. Irritation of the parietal peritoneum appears to inhibit the stomach's motility; irritation of the abdominal organs by handling or instrumentation may stimulate or depress the motor functions of the stomach according to the degree of irritation.

Gastroenterostomy. The *treatment of peptic ulcer by gastroenterostomy* is elaborated by C. H. Mayo:[8] The mechanics of the stomach by which the digestive fluids are produced is very delicately developed. In this respect it is much more efficient than if it were under voluntary control, although it may quite often be stimulated and upset in its function by psychic action. By working on the theory of cell activity and its control by types of food, Sippy, taking advantage of the action of fats in delaying digestion and reducing the acidity with the additional administration of alkalies, has developed a very good system of control by variation in diet and frequency of administration of food. Unquestionably, much may be accomplished along this line. Mayo would take issue, however, with the statement that gross ulcers are comparatively frequent or readily healed. Such ulcers are rarely multiple and the heavy induration prevents healing by preventing approximation of the mucosa.

The first operations were anterior gastroenterostomies. If there was marked obstruction, the operation gave great relief. Later came the posterior attachment. Then commenced the problems of gastroenterostomy, for, as knowledge of the symptoms of ulcer and improvement in the technic increased, the operation was no longer one of necessity only: it became one of expediency.

The fact the stomach is an organ largely affected by reflex disturbances from the eyes, mind, pelvis, appendix, gallbladder and nervous system, was often overlooked.

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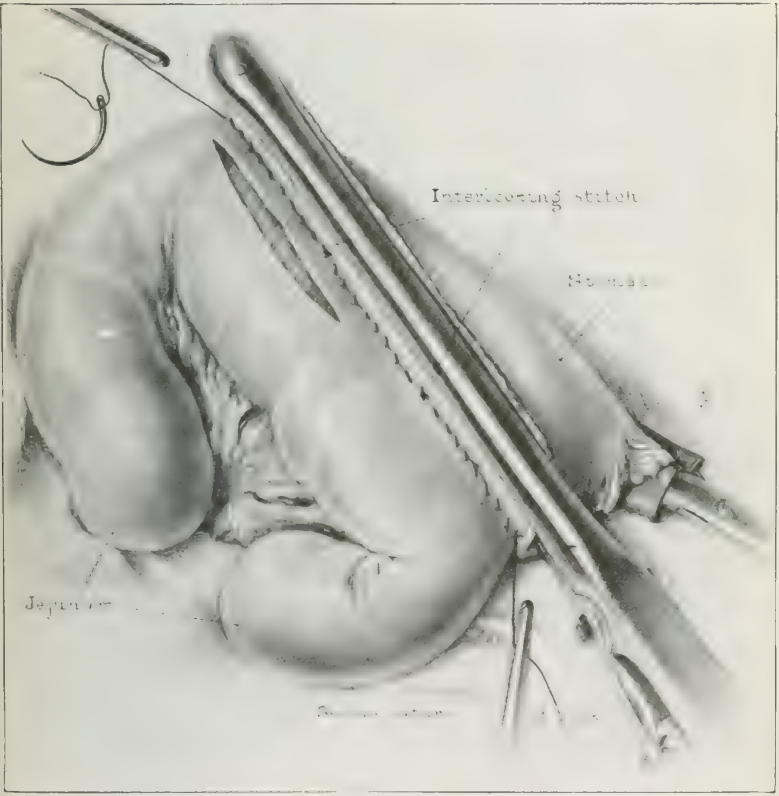
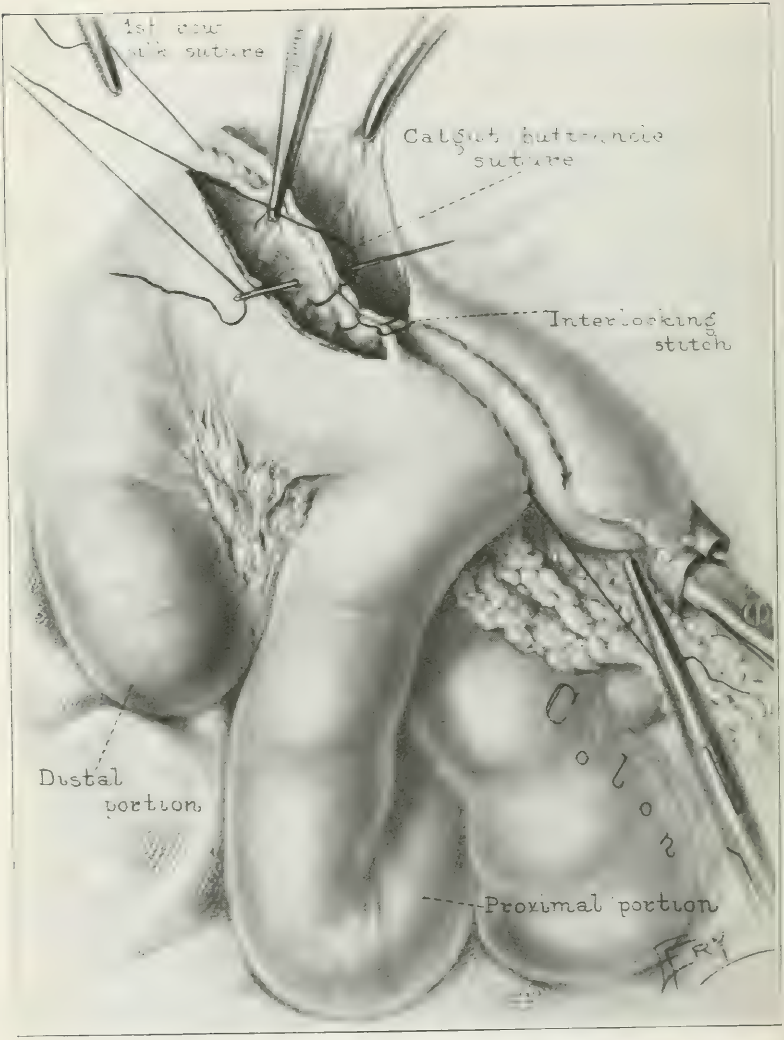
(8) Minnesota Med., January, 1919.

PLATE XXI.



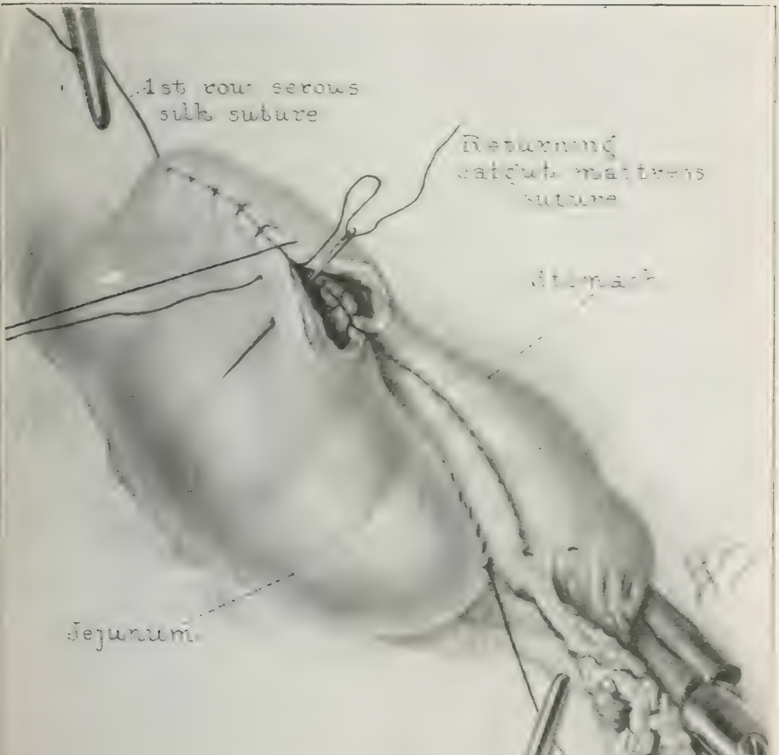
Gastroenterostomy. Jejunal attachment, approximate size of opening in bowel. Mayo. (See p. 384.)

PLATE XXII.



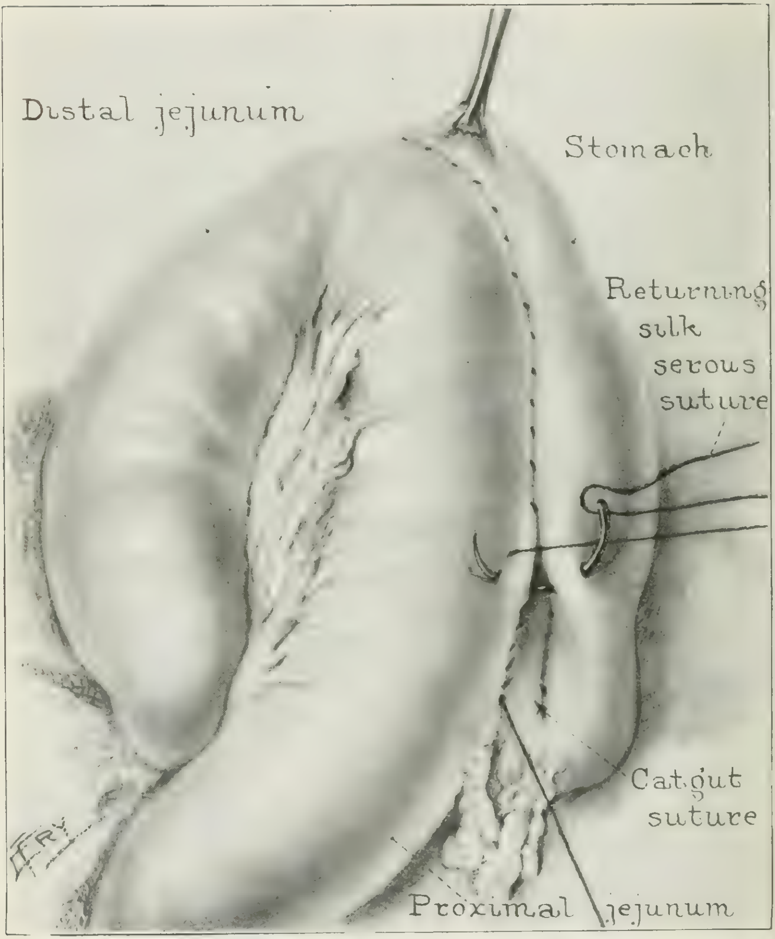
Same. Gastroenterostomy opening with partially closed end of stomach. —Mayo. (See p. 384.)

PLATE XXIII.



Same. Catgut suture closing gastrojejunal opening and continuing over closed portion of stomach to reinforce suture line. Mayo. (See p. 384.)

PLATE XXIV.



Same. Final row—serous suture completing suture line which protects the end
stomach with intestine. Mayo. (See p. 384.)

and operations for ulcer, as based on symptoms, were common. The long posterior or 9-inch loop often developed vicious circles; to avoid these, the loop was united proximal to the gastroenterostomy by suture or button, the Y (or Roux) operation was devised, the pylorus was excised and its ends closed, or it was obstructed. It was believed if food left the stomach in a new way the ulcer was relieved even when the pylorus was normal and without obstruction. The operation was changed by a few surgeons to plastic methods of enlarging the pylorus, which overcame obstruction due to spasm of the pylorus without changing the acidity. At this time the short loop and, later, the no-loop methods were devised. Most surgeons became aware that gastroenterostomy was an added burden with gastric reflex disturbance, and insisted on seeing the ulcer before operating on the stomach; or, if the ulcer could not be seen, rather than make an unnecessary gastroenterostomy, they investigated abdominal sources of gastric reflex for relief. The twist in the bowel for iso-peristalsis, as made in the long loop anterior operation, had been preserved in the posterior methods, and while it made no difference in the original method, the splenic loop, continuing the bowel to the left after crossing the spine, was twisted back upon itself, and in a truly short loop tended to obstruction in a certain percentage of cases. This led to more methods of blocking the pylorus by suture, by folding ligatures, round ligament, fat, fascia, and excisions, which were intended to force the stomach to utilize the new outlet. All of these measures were unnecessary from every standpoint, unless an ulcer on the gastric side of pylorus, as a tumor which potentially might develop cancer, should be removed. It was soon learned gravity played no part in the emptying of stomach, that it would remain dilated unless it was relieved by its own peristaltic efforts, and that these efforts could not overcome obstructive conditions in the intestine. If the latter were present the stomach would dilate and give trouble until the obstruction was relieved. Two other conditions would also cause it to dilate, first, injury of the innervation from wide excisions of ulcers on lesser curvature; and second, interference with the mesenteric circulation.

which often could be relieved merely by turning the patient on l. side or upon face. The dilatation from paresis required lavage often for 2 to 5 weeks, until innervation was restored. As excision is now made by the Balfour cautery method, paresis seldom occurs.

The best type of gastric cases for surgery is where every method of medical treatment has failed, or the patients have become tired of the rigid diet and care which is necessary to relieve or to prevent relapse. They greatly appreciate the relief obtained through gastroenterostomy, and the ability to return to work with the diet obtainable in their environment. (Plates XXI to XXIV.)

Some technical points in gastroenterostomy are alluded to by A. Schwyzer.[9] If the pylorus is patent, food will pass through it even after gastroenterostomy, and will appear at the afferent loop. The afferent opening will, therefore, not have the same tendency to contract as the distal jejunum, which in atony of the stomach is not forcibly offered food. Now as soon as there is no free outlet from the lower opening, the duodenum and jejunum above the stoma will become distended. In vicious circle the afferent loop becomes so ballooned the afferent opening is pushed out of the way. We, therefore, have to see the afferent opening cannot become too large, because by enlarging it annexes that originally neutral territory, the gut which lies between the ends of gastroenterostomy incision. It annexes it for the formation of a wide funnel, and the lower jejunal opening is then pushed to the wall and more or less shut by a spur. Besides the guarding against a too wide upper opening we must remember the upper loop can become very bulging. Even if upper opening is reduced in size, the distended loop above, though very short, could become so large it might compress the outlet. For this reason we do well to fix the afferent gut for some distance on the stomach. For the afferent gut it is desirable it lead rather freely away from stomach, and that its opening be somewhat funnel-shaped. To accomplish this in post. gastroenterostomy Schwyzer has for years used a simple means:

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(9) Surg., Gynecol. and Obstet., April, 1919.

1. The stomach is drawn through the slit in mesocolon as far as feasible.

2. The edge of mesocolon is fastened to stomach as far on periphery as possible. In front the mesocolon is often really fastened to the ant. wall of stomach by grasping the wall through the omental attachment, where it can be had between vessels.

3. The gastroenterostomy is made large enough to allow the tips of 4 fingers in it.

4. The loop is attached in the isoperistaltic sense; and the stoma extends from about halfway between the curvatures on the afferent (left) side to close to the greater curvature on efferent end. Thus, after the stomach is replaced, the gastroenterostomy opening has a downward course on the post. wall of stomach, and is as much a posteroinferior outlet as can well be procured.

5. After the posterior Lembert suture is placed, the gut incised down to the submucosa, 2d suture applied and the mucosa opened, he then makes it a point to grab with the 3d suture a broad edge of mucosa. It never appealed to him to excise the mucosa. What protects the tissues against secondary ulcer on the suture line is the mucosa, and for this reason secures a bulky covering by pulling ample mucosa over the wound. For the same reason that he is principally concerned to secure a tight covering with mucosa, great stress is not laid on carefully inverting the mucosa when the anterior half of suture is placed. If the edges are somewhat everted, the suture does not look as neat; but seen from inside there is no exposed submucosa. The middle suture buries this eversion, and the sewing goes more quickly.

6. The anterior Lembert suture is placed so that, after the distal half is finished in the ordinary way, it not only pulls the jejunum on proximal half over to the left and up by a slanting direction of the suture, but the suture in its progress toward the left angle gradually includes broader peritoneal surfaces and thus pulls the gut over onto the stomach. This creates a narrowing and a kinking of the afferent gut, and at the same time brings about a broader agglutination where the most pulling is to be expected. The lower jejunal opening is drawn into a more favorable position and its lumen is held free from

obstructing folds, while the upper is rendered rather inaccessible from the gastroenterostomy side. The kinking and therefore comparative inaccessibility for food of the afferent loop is probably a beneficent feature in the antiperistaltic attachment method; and this principle is underlying in Polya's method. (Plate XXV.)

Disappointments After Gastroenterostomy. These are considered first *from the medical standpoint* by R. Hutchison,[1] the well-known London internist:

The chief symptom of ulcer is pain, and the most certain result of the operation is its disappearance. In the great majority the relief is permanent, but in a few returns in a few months or longer. Such pain should suggest formation of an ulcer either in jejunum or at site of anastomosis. Vomiting is a less common cause than pain. More baffling than either of these are the cases where the symptoms point not to a surgical lesion, but to a profound functional disorder. One feature which is common to almost all these functional disorders is diminished gastric tone. It is probable this has been present even before operation; but in some it may date from the operation itself. Gastroenterostomy profoundly affects the gastric functions, and it is not the simple drainage procedure sometimes pictured. Given an atonic stomach which also empties itself too fast, we get an exaggerated sensation of sinking and emptiness so characteristic of ordinary gastric atony. The effects of too rapid emptying are aggravated by a consequent overfilling of the intestine which is often accompanied by some stasis, as revealed by the *x*-rays. In 2 cases stagnation had been carried so far that part of the jejunum beyond stoma had become dilated so as to form, as it were, an accessory stomach, as if to compensate for the practical abolition of the true stomach. An interesting symptom in 3 cases was glycosuria. How this is produced it is difficult to say. It has been small in amount and apparently not much influenced by diet. In at least one it disappeared after the anastomosis had been undone.

What can be done for these symptoms? Not very much, unfortunately, but considerable relief is experienced by an efficient abdominal support with a diet of

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(1) British Med. Jour., May 3, 1919.

small dry meals and recumbent position after food. Abdominal massage has a good effect upon the stasis. Drugs are not of much help. In 4 cases Hutchison was obliged to advise the anastomosis should be closed. The constant nausea, which was prominent in all, was got rid of, and they were all greatly relieved and brought back to comparative efficiency. The moral is that cases should be selected with greater care than is always exercised, and the opinion of a physician as to the advisability of operation should be obtained as well as that of a surgeon. Even with the greatest care mistakes in diagnosis will occur, but the surgeon should have the moral courage to close the abdomen if no definite organic lesion of stomach or duodenum can be demonstrated. In some of the cases seen there was strong reason to suspect that operation had been performed for atonic dilatation or gastroptosis only; the results are always bad. Even when an organic lesion is present the coexistence of decided atony is a contraindication unless prolonged medical treatment has failed to relieve.

Sir B. Moynihan[2] considers the *disappointments from the surgical standpoint:*

(*A*) Operation has been done without organic lesion. For functional disorders, or for chronic disease elsewhere than stomach. This class accounts for 90%.

(*B*) Operation incomplete. It appears to be still a custom to perform gastroenterostomy only, leaving the ulcer itself untouched, and making no search in the abdomen for other conditions. As these ulcers are probably often, if not always, secondary to some infection which may exist, such a search should be a necessary part of every operation, provided the condition will warrant it. Chronic appendicitis is very frequently associated, probably in a causal relation. It is better, therefore, always to remove the appendix. The division of a "Lane's kink" may also be practiced. The gall bladder should always be examined for stones, or of that subserous deposit of fat, especially near pelvis, and the cystic duct, the first sign visible from the exterior of an infection of the gall bladder from within. Either the removal of

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(2) British Med. Jour., July 12, 1919.

stones and drainage or removal of the bladder may be necessary. Merely to perform gastroenterostomy in duodenal ulcer is therefore to leave open many chances of subsequent disaster. A direct dealing with the ulcer is always necessary. In patients upon whom gastroenterostomy alone has been performed, there may be a recurrence of all the original symptoms of duodenal ulcer. In such cases either a jejunal ulcer, or a revival of activity in the duodenal ulcer is present. If the latter, infolding of the ulcer, and its protection by a double covering of the omenta, will remove the symptoms at once. An *x*-ray before operation will probably show that much food passes by the pylorus. Moynihan rarely practices either excision of the ulcer, exclusion of pylorus, or partial duodenectomy and gastrectomy in duodenal ulcer, for the results of gastroenterostomy are hardly to be improved.

[The fact that gastroenterostomy when properly performed, removes stasis with its accumulation of acid and decomposing food, and that it provides for the alkalinization of the stomach contents through the presence of the alkaline bile and pancreatic fluid, gives this operation its enormous value.—Ed.]

(*C*) Defective Technic. The operation has been performed, rightly or wrongly, and certain technical errors cause distressing symptoms—pain, vomiting, etc.

The chief of these occur when—I. The operation has been performed, and a long jejunal loop has been left. This loop may, with difficulty, be emptied; it may become "water-logged," and an obstruction may develop at the afferent opening into stomach. "Regurgitant vomiting" occurs, only to be relieved by lavage, or in severe cases by enteroanastomosis, which checks it at once. 2. With a short or a long loop, the efferent jejunum has been blocked as a consequence of a kink, or from adhesions. Regurgitation occurs here also. Regurgitant vomiting means high obstruction. 3. A short-loop post. gastroenterostomy has been performed. At the time when the jejunum was lifted up to oppose to the stomach before suture, adhesions were found binding it to the under surface of the transverse mesocolon. These were divided and a raw surface left on the jejunum, proximal to the opening made to anastomose with stomach. Adhesions then formed and caused obstruction of the proximal part of the jejunum between the duodeno jejunal flexure and the stoma. 4. The jejunum has been rotated round its axis at the time when approximated to stomach. This twist may be quite enough to cause obstruction. 5. The opening is too small. It should always be large; not less than 2½ in. in length.

6. The opening should always reach the greater curvature and is best placed in line with the esophagus. Whether the jejunal direction is vertical, or inclines from left to right, or right to left matters very little. 7. There has occurred a hernia of the small intestine through the unclosed rent in mesocolon. The edges of the mesocolon opening should be sutured either to the stomach or to the suture line. If they are attached to the jejunum alone the stomach may withdraw into the lesser sac, and so cause a kink or obstruction near the stoma. 8. The use of unabsorbable sutures—silk, linen, thread, thick chromic gut. Catgut is to be preferred to any other material. It remains long enough to ensure firm union between the viscera, and disappears in a few weeks' time. The catgut should be as fine as is compatible with adequate strength. In many cases of hemorrhage some weeks or months after operation the liberation of an unabsorbable suture may be the cause. Such sutures may be seen hanging from the line of anastomosis when later operations are performed. Moynihan found a piece of stout chromicized catgut 45 months after the original operation. Of the 2 sutures it is certain the outer one, the sero-serous, is the one so long retained. The inner stitch, which apposes the cut edges of mucosa, is probably always discharged within a very few weeks, whatever the material of which it is composed. The use of linen and silk is perhaps responsible in some degree for jejunal or gastro-jejunal ulcers. The sutures have to work their way out, and so delay healing, or start an ulcer at any point.

(*D*) Late complications may develop in operation properly performed. These comprise jejunal ulcer, and carcinomatous change. He refers to an instance of the latter in one of his cases, 13 years after operation.

Symptoms after Unsuccessful Gastroenterostomy.

Pain may be due to: 1. A revival of activity in an unhealed ulcer. 2. The presence of a jejunal ulcer. 3. Adhesions crippling the proper action of stomach or jejunum. 4. Some other disease which has been overlooked—chronic appendicitis, cholelithiasis, etc.

Hemorrhage may be due to: 1. The separation of a suture. 2. Continuing activity in a duodenal or gastric ulcer. 3. A jejunal ulcer. 4. Some other disease which has been overlooked, splenic anemia, cirrhosis, etc.

Vomiting may be due to: 1. Obstruction as a result of any technical defect. 2. Functional causes.

Diarrhea may be due to: 1. Too rapid emptying of stomach. 2. Some pathologic condition of viscera which has been overlooked. 3. The offensive character of the escaping contents.

A *gastrojejunal ulcer* occurring 6 years after a gastroenterostomy was encountered by A. H. Bogart.[3] The patient, a man, of 53, remained quite well until taken suddenly with a dizzy spell and weakness. At the same time he suffered severe pain in stomach which was more or less continuous until October when he had a similar attack, vomited blood and had bloody stools. Because of pain caused by eating not relieved by anything except morphin, had lost considerable weight and strength. At operation ulcer was found at the old anastomosis, most marked on stomach side. The complications were so great it was deemed impossible to remove it and save the patient in his weakened condition. An opening was made through ant. wall of the stomach to determine if the ulcer could be removed in that way but also found impossible. The wounds were closed and patient died from exhaustion within few days.

The cause of these ulcers is not yet clear, perhaps the most common theory is they are due to a non-absorbable suture which is frequently used in the original operation. In this case however there was no evidence of foreign material as a cause.

[It seems likely that the position of the opening in the stomach may have much to do with the development of jejunal ulcer following gastroenterostomy. In the cases

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(3) Long Island Med. Jour., September, 1919.

we have encountered, this opening was not at the lowest point in the greater curvature, and there was an accumulation of acid gastric contents in the pouch formed by this error, and we have attributed these ulcers to irritation caused by this acid fluid.—Ed.]

R. Warren[4] places on record a very rare and late sequel of gastroenterostomy—*retrograde intussusception of jejunum through stoma.* A man, aged 61, admitted for hematemesis. Thirteen years ago underwent gastrojejunostomy at another hospital for gastric trouble, with very good result; remaining well for 12 years. One year ago he began to have abdominal pain after meals and vomiting, which relieved the pain. There were remissions of as much as a month. Two days before had a worse attack with hematemesis, which continued till his admission.

A few adhesions of the transverse colon to the abdominal wall were separated, the stomach and pylorus appeared normal in front. Turning up stomach the distal loop of the jejunum coming from the stoma was turgid and purple for 8 in., at which point the entrance of a retrograde intussusception was found. This passed up the turgid distal jejunal limb, its apex projecting about 3 in. into the stomach through the stoma, and was, in fact, an elongated swelling felt through abdominal wall. The intussusception was reduced without great difficulty, and had started apparently about a foot below stoma. The reduced gut was very purple, but at no point could any thickening suggestive of ulceration be felt, and the gut appeared viable; abdomen closed. Duration 20 min. After a slight brown vomit the next day patient improved till 7th day, when respiration became rapid, and he began to bring up offensive sputum, and finally died on 10th day.

Necropsy, the lungs were in a condition of severe bronchopneumonia with many abscesses; the abdomen, except for slight plastic peritonitis about the intussusception and remains of bruising of the gut, was normal. The gastroenterostomy as seen at operation proved to be in excellent order, of good size, and well planned. The reason of the intussusception and its relation to the late

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(4) Lancet, Oct. 4, 1919.

dyspepsia and vomiting does not appear certain. At any rate, there was no evidence of a peptic jejunal ulcer before or after death.

Gastric and Duodenal Ulcers. In 26,000 admissions to the S. Pacific Hospital, *8 perforating gastric and duodenal ulcers* were encountered, according to J. H. O'Connor,[5] none diagnosed before admission.

The chief symptoms in the order of their value are: Pain and tenderness. Rigidity. History of previous ulcer symptoms. Vomiting.

One patient died before operation; of the 7 operated on, 5 recovered, the interval between perforation and operation being 3, 9½, 13, 36, and 38 hours. In the fatal cases the interval was 36 hours in one, and in the other unknown.

The Swiss Surgical Society undertook *a collective investigation* on the surgical treatment of gastric and duodenal ulcers. The results are edited by E. Kummer,[6] of the University of Geneva and are important for comparison with similar ones from this country and England. They are furnished by 23 members, and of the 5 Swiss clinics, 4 are represented—three for 1890-1917, one for 1910-7. The other one at Aarau (Bircher's) is the subject of a separate report (*post.*).

Starting with the distinction between gastric and duodenal ulcers the Mayos and Moynihan, according to Kummer, believe the external boundary is furnished by the pyloric vein. Ulcers to the l. being gastric, to the r. duodenal. To this Hartmann objected, that the vein was not always visible, and even its location, though generally rather near the pyloric sphincter, far from constant. In 104 cadavers, Sarmiento (1913) found in 66 the vein corresponded exactly to the sphincter, 16 times it was displaced to the side of cardia, 17 times to the duodenal side; and was invisible in 5. As this line is inexact, Kummer believes most of the discrepancies in the statistics are due to this fact.

The sex-incidence of fatal cases of gastric and duodenal ulcers for the whole of Switzerland (1910-6) was 1060 males: 711 females. The ages were:

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(5) California State Jour. Med., August, 1919.
(6) Corr.-Bl. f. Schw. Aerzte, May 17, 1919.

Under 1 year	12
1 to 19	29
20 to 29	83
30 to 39	193
40 to 49	296
50 to 59	433
60 to 69	430
70 to 79	261
Over 80	34
	1,771

The location in the operative cases was:—

Stomach:

Prepyloric region	601
Lesser curvature	309
Posterior wall	57
Not noted	56
Anterior wall	50
Multiple	36
Greater curvature	19
Cardia	13

Duodenum:

Postpyloric region	196
Superior flexure ("bulb")	74
Not noted	25

The frequency of cancer was as follows—

1890-1910:

8 cases in 357 gastroenterostomies for gastric ulcer.
0 cases in 41 for duodenal ulcer (or 2% of secondary cancers).

1910-17:

0 cases in 543 gastroenterostomies for gastric ulcer.
1 case in 211 for duodenal ulcer (or .13% of secondary cancers).

Gastroenterostomy, the operation most resorted to by the 23 surgeons, has a mortality of later years of only 3%, against 15 formerly. Hence performed for simple and callous-penetrating ulcer it is on an average 5 times less dangerous. Roux, the president of the Society, has even a lower rate—1.7%. Perforating ulcer, practically always mortal without operation, is followed by the highest death rate, but here again the improvement is considerable—29% against 57% in former years. Kummer believes the causes for the improvement, in addition to the better technic, are the early operations done nowadays. Here great credit is due to the family physicians who recognize perforations sooner, and advise immediate interventions.

Postoperative disturbances include poor function of the stoma, peptic ulcer, and secondary cancer, though as just shown, this last only occurs in .13% of all operations, both gastroenterostomies and resections. The total of postoperative complications was 46 in 1436 operations (about 3%). Here too, Roux's results were excellent, no case in 212 gastroenterostomies since 1910.

In the former period, most deaths followed operations for non-perforating ulcers, recently, on the contrary, the largest contingent is furnished by the perforating class: in other words the chances of the patients were already compromised before operation, they died of the disease much more than the surgical treatment, another proof of the advance in technic.

In the latter period the gravity of operations by the members in resections and excisions has been triple that of gastroenterostomy, no matter what the nature of the ulcer was for which operation was done. This is a serious argument against the view that annular mid-gastric resection is the best method for all simple extra-pyloric ulcers of the stomach. The additional danger (7% mortality against 3% for g. enterostomy) is not justified in Kummer's belief, unless the functional results of resection are better. Yet they were as identical in the 42 resections in his table as in the 423 gastroenterostomies, hence a much higher percentage for the latter. Again there are disorders of emptying in resections, precipitate evacuation in DeQuervain's cases, but retarded in Kummer's own cases. Granted that resection is indicated in certain cases of penetrating ulcer, of peptic ulcer, of malfunction of stoma—in which it may give remarkable results—Kummer is of opinion it is not the choice for simple ulcer.

He concludes there is no doubt there is a very marked tendency to cure with the aid of severe and prolonged medical treatment. Some individuals are so situated they can undergo this long course of treatment, while others working for their living, possibly not in such bad state, need some speedier plan. Moreover, a certain category are refractory to medical treatment, the ulcers persist in a more or less latent state, recur after a temporary remission or become the seat of complications curable only by operation.

For simple and callous-penetrating ulcers, the chances of cure by gastroenterostomy, according to the figures of these Swiss surgeons is 88%, with a mortality of 3% from the operation. Of the remaining 12%, a certain —unknown—number have been benefited by one or more subsequent interventions, others remain definitively incurable, or succumbed to the indirect sequels of operation.

E. Bircher[7] had 296 operative- and 95 non-operative cases. The former comprised 189 gastric ulcers, 67 duodenal, 36 multiple, and 4 peptic. The sites were—*Stomach:* Prepyloric, 107; lesser curvature, 58; multiple, 36; post. wall, 16; cardia, 4; greater curvature, 3; ant. wall, 1. *Duodenum:* Postpyloric, 59; sup. flexure ("bulb"), 8. *Jejunum:* peptic, 4.

The operative procedures were—

Excision		11	
Transverse resection		40	
Billroth I, 26; Billroth II, 16		42	
Gastroenterostomy:			
Post. retrocolic	101		
Ant. antecolic	45		
Retrocolic with closure of pylorus	32		
Retrocolic-gastropexy	15		
Retrocolic with pyloric exclusion (Eiselsberg)	5		
			198

Operative mortality—183 gastroenterostomies, 9 deaths (7 uncomplicated cases, 2 with perforation). Excisions, 11 with 1 death. Resections, 82 with 9 deaths (6 operative, 3 carcinoma).

End-results—Gastroenterostomy for gastric and duodenal ulcers: Healed, 80 cases; improved, 33; unimproved, 24. Resections (58 gastric- and 2 duodenal ulcers). Healed, 50 cases; improved, 5; unimproved, 5.

Gastroenterostomy: Healed, 57%; improved, 24.7%; unimproved, 17%. Resections: Healed, 83%; improved, 8.3%; unimproved, 8.3%.

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(7) Ibid.

Giving details of *5 operations for gastric ulcer* with 2 deaths, W. J. Carter[8] claims that to credit surgery with the failure is to place the responsibility in the wrong place, since each of these cases represents a medical failure either of diagnosis or treatment and surgery claims 60% cure. It seems to him time the profession as a whole should cooperate to the mutual benefit of all concerned as there is enough responsibility for physician, internist, and surgeon, and without the cooperation the patient is not getting from the profession all he has a right to expect.

N. M. Percy opening the discussion said a large percentage, especially of acute ulcers, should be treated medically, and if treated properly will recover and remain well, provided they live under reasonable conditions, and provided they are not left with a chronic gall bladder infection, which may often be a predisposing cause of the ulcers. He does not believe that the acute case with severe hemorrhage is necessarily an indication for surgery. This should be left entirely for chronic recurrent cases, so far as gastric ulcers are concerned. The types of cases described are the ones which are very apt to do well following surgery. For instance, the type with a large prepyloric ulcer with marked obstruction usually does well.

As to the operation itself, the thing of most importance in connection with a gastroenterostomy is its location, not so much how it is done or what it is done with, but location. If a gastroenterostomy is made well over in the pyloric end, as near the pylorus as possible, they usually work well. If it is made near the center of the stomach, they work well for a time, but these cases finally have trouble.

D. C. Balfour[9] takes up *surgical treatment in bleeding gastroduodenal ulcers.* His paper is concerned chiefly with 2 groups: (*A*) where operation has proved unsatisfactory because of error in attributing the bleeding to a lesion which is not present, and (*B*) where the procedure carried out has failed to obviate further

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(8) Illinois Med. Jour., November, 1919.

(9) Jour. Amer. Med. Ass'n, Aug. 23, 1919.

hemorrhages, even though a correct diagnosis has been made.

The records of the Mayo Clinic show that 25% of gastric ulcers and 20% of duodenal ulcers have been complicated by one or more gross hemorrhages. In the earlier days gastroenterostomy proved so efficient in a large majority of benign lesions of the stomach and duodenum with hemorrhage the realization came rather slowly that at least some of the failures to obtain a complete cure, could be attributed to the fact that direct attack on the ulcer was not added to the indirect therapeutic measure.

Hematemesis in Duodenal Ulcer in Which Operation Was Done. Jan. 1, 1906, to Jan. 1, 1918.

	Cases, No.	Per Cent.	Operative Mortality All Causes Per Cent.
Total number	2,875	....	1.6
Patients having hemorrhage before operation	583	20+	1+
Patients having hemorrhage before operation heard from	494	86.0	....
Patients reporting hemorrhage after operation	63	12.7*	....
Patients reporting hemorrhage after operation but not before	20	0.9	....

* Or 2 per cent. of the total number.

Hematemesis in Ulcer of Stomach in Which Operation Was Done.

	Cases, No.	Per Cent.	Operative Mortality All Causes Per Cent.
Total number	863	....	3+
Patients having hemorrhage before operation	222	25.8	4.8
Patients having hemorrhage before operation heard from	180	81+	....
Patients reporting hemorrhage after operation	15	8.0*	....
Patients reporting hemorrhage after operation but none before	2	0.3	....

* Or 1+ per cent. of the total number.

(The technic is described in the 1915 volume, p. 363).

Emphasis is laid on the following points: Hemorrhage following operations for both gastric and duodenal ulcer is of sufficient frequency to warrant a revision of operative methods in such cases. Gastroenterostomy or pyloroplasty alone does not always protect against further hemorrhages, while excision and gastroenterostomy gives almost total protection. Excision by cautery combined with gastroenterostomy is the most satisfactory in the majority of minimizing the possibility of recurrence of hemorrhage in all ulcers, and similar treatment seems advisable in both gastric and duodenal ulcers which have not exhibited such a complication. (Plates XXVI, XXVII, XXVIII.)

In his consideration of *operative treatment of gastric ulcer*, J. Taylor[1] states at a training camp 65 operations were done—60 posterior gastroenterostomies with 1 death, 3 excisions of ulcers, and 2 partial gastrectomies, all successful. Some 14 gastroenterostomies were performed for acute perforation.

A case of hour-glass contraction was of special interest. The patient was 53 and for over a year had suffered from frequent vomiting. *X*-ray showed a well-marked stricture a little to r. of cardiac orifice. The stomach was found to consist of 2 sacs connected by a narrow opening in the region of the lesser curvature. The middle portion was excised, and the proximal and distal halves joined end-to-end by a double layer of sutures. Two months later, (*x*-ray) the shape of the stomach was practically normal, and patient had had no more gastric trouble.

Six patients in addition to the above were operated on to arrest severe hemorrhage. They had undergone prolonged medical treatment and were only operated on as a last resort. Therefore, each of the recoveries may be regarded as a life saved. In 2d case, active hemorrhage was going on at the operation and patient was nearly pulseless, so he had practically no chance. The other death does not appear to have been due to the operation. The patient was the least exhausted of all, but in 12 hours died in an epileptic fit. It is an open question whether more cases would not be saved if operation were resorted to sooner. None of these patients were fit to stand excision of ulcers, or opening of stom-

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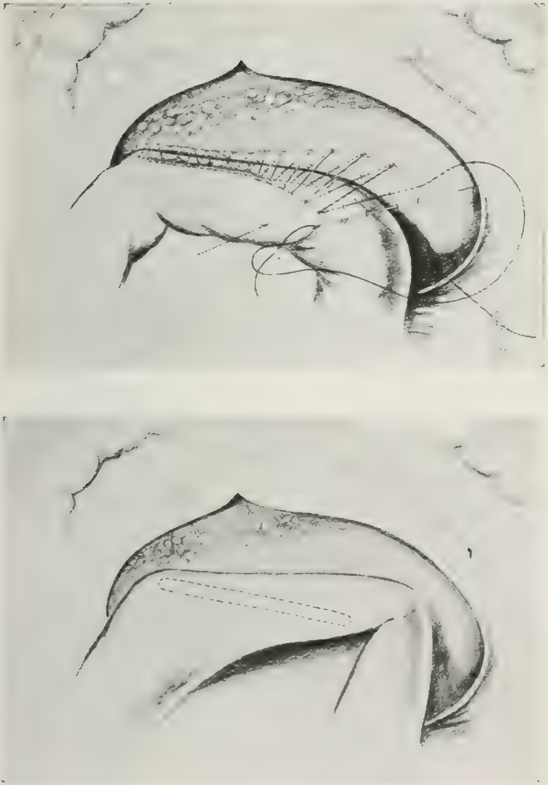
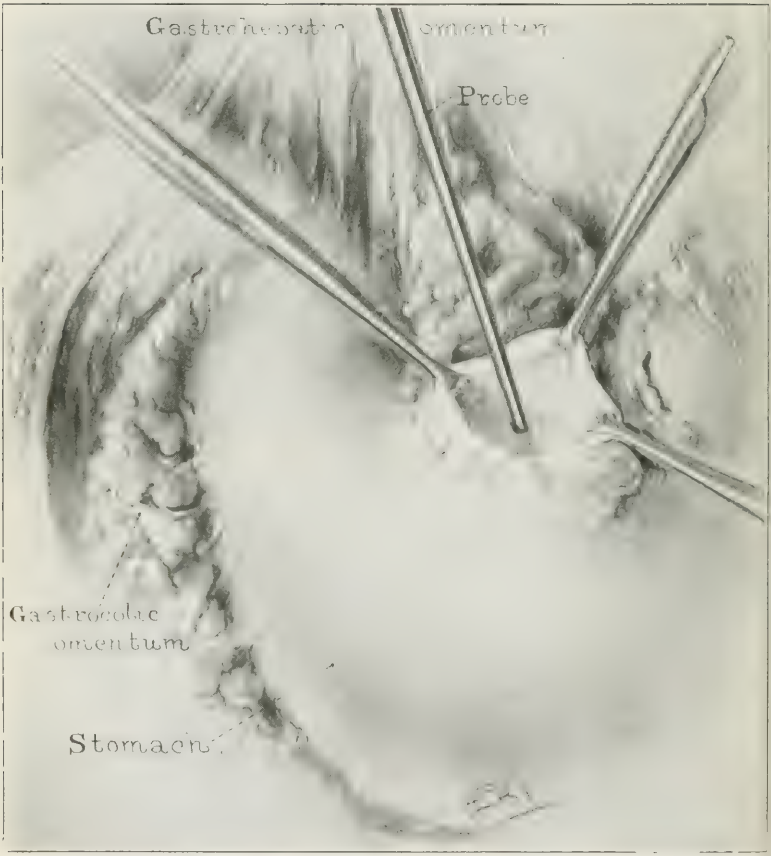
(1) Practitioner, September, 1919.

PLATE XXV.



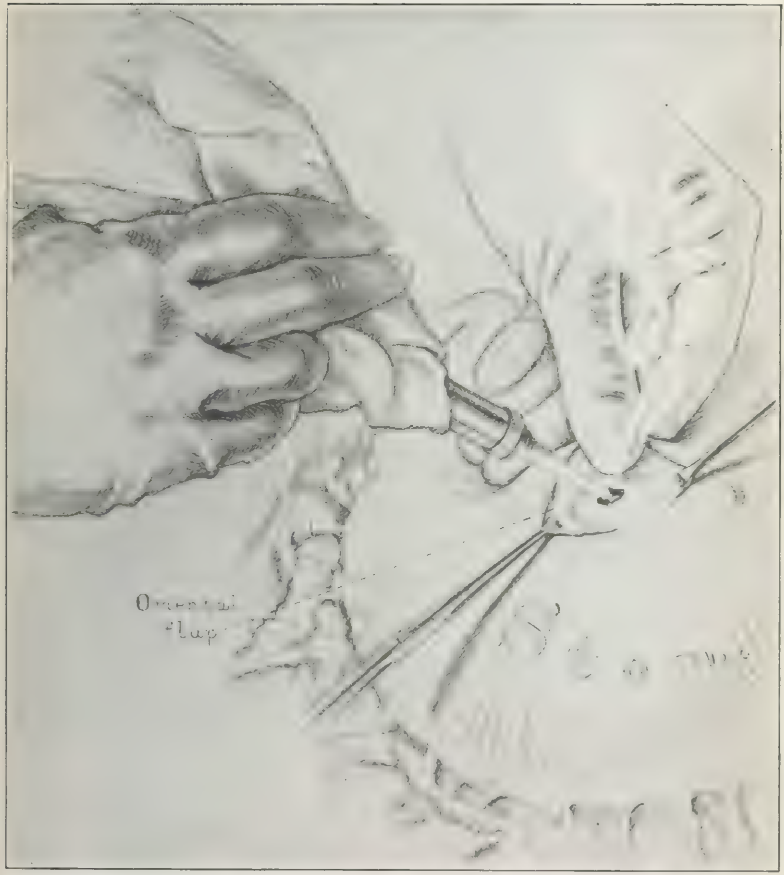
Technic of gastroenterostomy. Schwyzer. (See p. 386.)

PLATE XXVI.



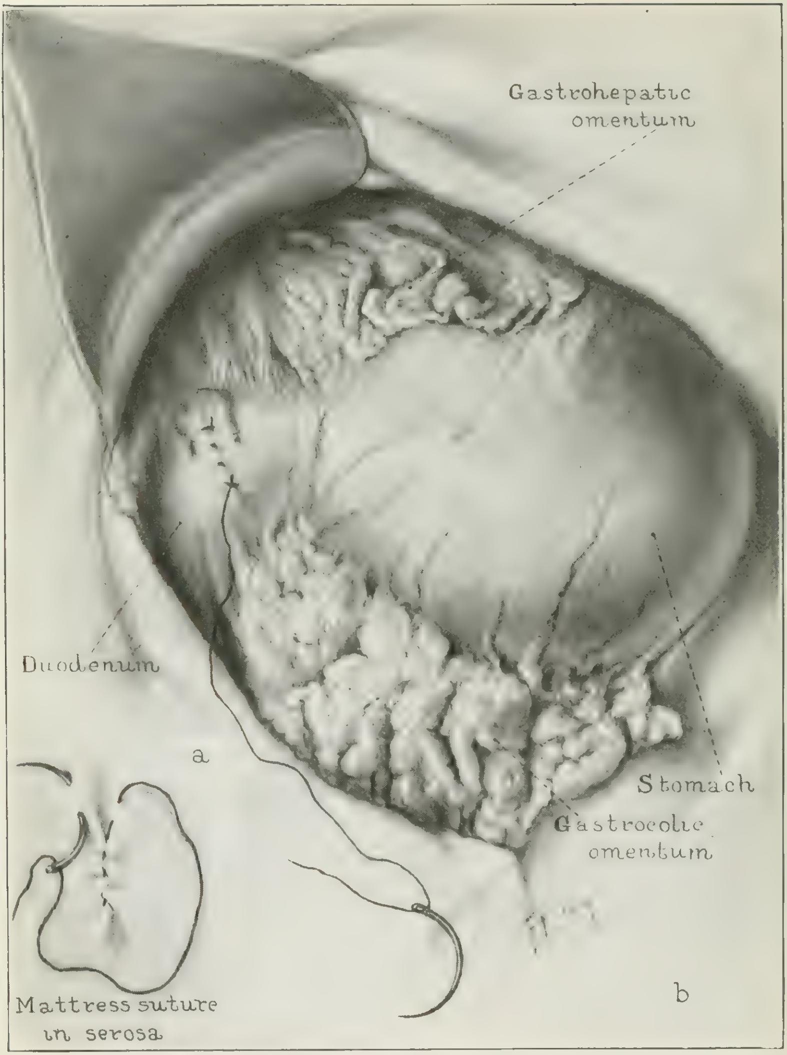
Surgical treatment of bleeding gastroduodenal ulcers. Probe introduced through site of chronic perforation.—Balfour. (See p. 398.)

PLATE XXVII.



Same. Peritoneal surface of ulcer prepared for application of cautery.
Balfour. (See p. 398.)

PLATE XXVIII.



Same. *a*, cauterized opening closed by row of catgut; *b*, closure reinforced by a returning second continuous suture. Balfour. (See p. 398.)

ach to look for the bleeding point. A rapid gastroenterostomy seems to be quite efficient. In 5th case, ligature on each side of ulcer arrested the bleeding.

[The transfusion of 600 c.c. of whole blood, *i. e.*, without the addition of sodium citrate, will cause one of these hemorrhages to stop at once in our experience. In the meantime no food or water must be given by mouth, the patient being fed by means of nutrient enemas.—Ed.]

J. B. Deaver[2] discusses *removal of ulcer with gastroenterostomy* or *gastroenterostomy alone*. It is claimed by many that the latter of itself is curative, and so it is for a time. But if ulcer is allowed to remain, it may or may not heal, and experience has shown that to insure a positive result it must be removed. Gastroenterostomy without resection of the ulcer makes an indirect attack on the ulcer, diminishes the acidity of gastric juice, thus reducing the various distressing symptoms, especially pylorospasm. When stoma is large enough and properly placed it also obviates the stagnation of the contents and hastens the evacuation time of the stomach.

Resection plus gastroenterostomy presents the same advantages as the less complete one with the added benefit of reducing if not removing the chances of carcinoma (in gastric ulcer), of perforation and hemorrhage, except in the rare overlooked multiple ulcers.

In a year, perforation occurred in about 5.2% of Deaver's cases. Every medical man has had the unpleasant opportunity of observing perforation occur while a patient has been in a hospital or in his own home undergoing medical treatment for what is essentially a surgical condition. The proper time for medical treatment for the results of chronic indurated peptic ulcer is not before but after the operation (if treatment is then still needed). For with the removal of the ulcer or with its exclusion from the corroding action of the digestive juice the damaged mucosa has a better chance of responding to treatment and of complete cure. Carcinomatous degeneration, in spite of widely divergent statistics, is a decided menace.

[It is doubtful whether carcinoma can develop in a gas-

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(2) Annals of Surg., November, 1919.

troenterostomised stomach if the operation is placed at the lowest point, so there can be no stasis of acid contents; except in cases in which cancer was present in the ulcer at the time of operation, because cancer does not seem to develop in an alkaline medium in the alimentary canal.—Ed.]

It is the difficulty of transgastric resection, *e. g.*, for a chronic ulcer at the lesser curvature that leads many a surgeon to content himself with a gastroenterostomy, especially when the condition is of long standing and has led to hour-glass contraction, and extensive adhesions. But he cannot expect the same satisfactory end-results as from resection.

There are, of course, circumstances when it is expedient to omit the gastro-intestinal anastomosis. As, in ulcers distant to the pylorus with very little exudative induration. Simple excision may suffice. This also applies to saddle-back ulcers and those on lesser curvature toward the cardia. for which circular resection is the indicated operation. It has been Deaver's practice for a number of years not to follow circular resection with a gastroenterostomy. But he has on 2 occasions had to do a post. gastroenterostomy as a secondary operation after circular resection; since which time he is becoming convinced of the advantage of making the anastomosis at the primary operation.

For perforation of a duodenal ulcer it is best after closing the perforation to plicate the duodenum and fortify the area by covering it over with the gastro-colic and hepatic omentum, completing the operation with a post. gastroenterostomy. This is being more and more recognized as the proper procedure for acute perforating peptic ulcer. The 2-stage operation has lost any favor that in the early days it may have enjoyed.

Since 1915, up to January, 1919, Deaver treated 18 perforating peptic ulcers, and in 14 appendectomy, and in 2, in addition to the appendectomy, cholecystectomy, formed part of the operation.

To Jan. 1, 1919, the total number of perforations have numbered 56 operations with 2 deaths. One death occurred 22 years ago and the other during the past year; thus making 54 consecutive operations with 100% recoveries. In all but two closure of the perforation followed by gastroenterostomy was used.

End-Results. Those of some *87 operations for gastric- and duodenal ulcers* at Bull's clinic (Christiania) from 1902-15, are reviewed by O. C. Borchgrevink.[3] In 78 primary, and 12 reoperations the mortality from peritonitis was 3.3%. He blames the Murphy button for perforation causing peritonitis in one of the 3 fatal cases. In another the vicious circle could not be broken up. In another advanced pulmonary lesions explained the fatality, and in the fifth the man of 56 with hour-glass stomach vomited blood repeatedly and died in progressive weakness. Of the 65 patients followed to date, 55.3% were free from all disturbances and 35.3 had only insignificant ones, but in 9.4 the condition had not been improved, and even a second operation had not remedied the condition. Or, 90 per cent. good results and 10 frankly bad. This latter group included ulcer near pylorus, remote from pylorus, and duodenal ulcers. In the juxtapyloric and duodenal the outcome was good in all but 8%, most bad results and fatalities being encountered in the hour-glass cases. Simple gastroenterostomy seemed to give as good results as resection in the juxtapyloric and duodenal cases. The dread of cancer later is not an argument as cancer occurs after resecting operations. The results of gastroenterostomy with gastric ulcers at a distance from the pylorus are far from equaling those of the other groups.

The *end-results of operations for gastric- and duodenal ulcer* have been investigated at the Mayo Clinic from a novel viewpoint, and the findings are set forth by D. C. Balfour.[4] The cases for 1906-15 were traced by the Actuarial Society, and of 2431 operations, all but 108 were traced.

The Society's investigations of the mortality in the years after operation show: *Gastric Ulcer.*—501 patients were under observation on the average of 3.6 years, and in that time 88 (17 per cent.) died from all causes. *Duodenal Ulcer.*—1651 patients were under ob-

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(3) Acta Chirurg. Scand. (quoted in Jour. Amer. Med. Ass'n, Nov. 15, 1919).

(4) Annals of Surg., November, 1919.

servation on the average of 3.4 years, and in that time 85 (approximately 5 per cent.) died from all causes. *Gastric and Duodenal Ulcer.*—91 patients were under observation on the average of 3.8 years, and in that time 9 (10 per cent.) died.

Balfour observes the percentage of operative deaths in the hospital following operation for gastric ulcer was fully twice that of duodenal ulcer, but the percentage in both was very low considering the seriousness of the condition. The mortality during the 3 years following the operation among persons operated on for gastric ulcer was three times as high as that for duodenal ulcer. The mortality among persons operated on for gastric ulcer decreases relatively after operation, but the data are not sufficient to determine the time which must elapse before the death rate is similar to that of the general population. The mortality for duodenal ulcer in this series was less than that among the general population. The average age of those operated on for gastric ulcer was 47 for men, and 43 for women; for duodenal ulcer was 44 and 42, respectively.

Recurrent Ulcer. At the N. Y. Surgical Society, J. Rogers(5) presented a woman, of 26, who gave a long history of epigastric distress beginning in 1915. In August, 1917, she was operated upon for gastric ulcer and an hour-glass contraction found. The surgeon excised an ulcer about 1 in. wide from the centre of lesser curvature, after separating from the ulcer a strip of the great omentum which indented the greater curvature, the stomach resumed its normal outline, and he therefore only closed the space left after the excision. The epigastric pain and distress were only partially relieved. After resuming work the symptoms increased and were accompanied by recurring vomiting.

When admitted the gastric analysis showed a total acidity of 20, and the radiograph a typical hour-glass contraction at the junction of the upper and middle thirds. The test meal had apparently been recovered only from the upper pouch. Abdomen opened through l. rectus. The stricture under the costal arch could only be partially drawn into the wound. A band from the

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(5) Annals of Surg., May, 1919.

great omentum was separated from the ulcer in the concavity of the indentation on the lesser curvature, and this allowed the indentation on the greater curvature to disappear. The borders of the indentation on the lesser curvature with the ulcer at the bottom were then resected, leaving intact about 1 in. of the ant. and post. surfaces at the greater curvature. In this area along the greater curvature there was no scar tissue. After the removal of this V-shaped segment, the borders of the wound were sutured so as to restore almost perfectly the normal contour and abdomen closed. In the next 24 hours the condition was precarious, as the operation was long and difficult, but the recovery was then uneventful. A radiograph a month later showed the hour-glass contraction had already partially reformed, and the patient presented to show the apparent necessity of complete transverse resection in these cases, even though at operation a part of the "hour-glass" contraction is free from cicatrical tissue. At present, however, this patient has no subjective symptoms.

Another case is narrated by A. H. Bogart.(6) Recurrent ulcer following cautery operation, 2 years previous in a woman, of 48. She made a good recovery from this operation and was quite relieved for a time. In June she began to have pain in the region of the gallbladder which radiated up to angle of scapula, and shoulder. These attacks came on frequently. During the 3 weeks before entering hospital, they were very severe and patient was confined to bed. She also vomited during the attacks sometimes with slight traces of blood in the vomited material. With the history it was thought that patient was suffering from trouble in the gallbladder. with a possible recurrence of her old trouble.

Operation, Nov. 3rd. The gallbladder was found distended and the seat of a chronic inflammation. It was removed and the ducts examined for stones but none were found. Examination of the old ulcer showed there had been a recurrence though not apparently to the same extent as before previous operation.

A gastroenterostomy was done and patient again made a good recovery. Her symptoms did not immediately disappear and she required considerable attention from family physician, including stomach washing. She gradually improved, however, and at time of report was enjoying good health and taking a generous diet.

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(6) Long Island Med. Jour., July, 1919.

Perforations. The *absence of clinical symptoms during the preperforated stage* of duodenal ulcer, is commented on by L. J. Hammond.[7] Of 14 patients operated on in 2 years, not even the frequent complaint of digestive disorder is noted during their latent period. In none were paroxysmal pain, localized tenderness, vomiting, hematemesis, or hyperacidity complained of. The patients were, with two exceptions, male, ranging from 15 to 70 years, the greater number being between 20 and 30. The females were 22 and 26, respectively. None were chlorotic or anemic and there was no history of burns or other serious accidents that could have been a factor. In most instances the perforations occurred while patients were at their usual occupations. In one, during the night while asleep in bed.

The duodenum acts more as an intermediate than as a final agent in digestion. It might be called the preparing section, for it is here the various constituents of the pancreatic juice unite with the food and fit it for digestion. In order that amylopsin may act on starch, trypsin on protein, and steapsin on fats, the proper conditions must be present in the duodenum. The presence of ulcers which increases the acidity of the contents must therefore have a deleterious effect on the combination of the pancreatic enzymes with their particular foods.

From an anatomic and physiologic viewpoint, the arrangement of the nerve supply in close relation to a rich glandular supply in the submucosa of the duodenum is doubtless a great advantage. From a pathologic standpoint, however, it would seem unfortunate, for it robs one of his means of determining before the calamity the existence of ulcer of the perforative type, as the sudden inflammatory outpouring of secretion from the rich glandular supply promptly destroys the nerve impulse. This absence of symptoms, then, is usual, mak-

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(7) Pennsylvania Med. Jour., June, 1919.

ing it clear that after perforation mortality will be proportioned to the promptness of recognition.

In the last few years *60 perforated gastric and duodenal ulcers* have been seen at the Copenhagen hospital, and are tabulated by H. Hertz.[8] Only 17 were women, and the ages in general ranged from 16 to 75. In nearly half of the 13 duodenal ulcer patients no preceding symptoms had been noted before perforation. The absence of dulness over liver is an important symptom of the presence of air in the abdominal cavity, but in 12 the dulness was practically unmodified. In about 50 per cent. transient vomiting occurred at the time of perforation. Two patients presented 2 perforations and in several cases necropsy showed other ulcers besides the one perforated. Petren has reported several ulcers present in 27 per cent. of his cases. The amount of fluid escaping seems to be comparatively immaterial; some of the patients with the larger amounts recovered. In 12 of the patients the peritoneal contents developed cultures, in all but one of the staphylococcus; 7 of these patients died. At necropsy the suture had held perfectly; death was due to complications elsewhere.

No attempt was made to excise the ulcer in any case. Petren and Rovsing advocate excision, and have reported the recovery of all in their later series of 12 duodenal ulcer perforation cases, including 3 with a chronic fistula and no acute perforation. In only 17 of Hertz' 60 cases was the diagnosis correct when admitted; appendicitis was the usual assumption. The outcome of operative treatment was recovery in 75 per cent. of the 19 with a delay of six hours or less; 66 per cent. recoveries among the 12 with interval of from six to twelve hours after the perforation, while only 20 per cent. recovered of the 22 with a longer interval than this. The total mortality was thus 27 out of 53 operative cases (over 50%). Temperature is not of moment, but a pulse under 90 or 100 is a favorable sign as also a sterile peritoneal fluid, and good general condition; all the patients with signs of collapse died,

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(8) Ugesk. f. Læger (quoted in Jour. Amer. Med. Ass'n. Feb. 1, 1919).

as also all those with distended abdomen. The peritoneum should not be irrigated except in the cases seen late; and the same rule applies to drainage. Simple suture is preferable to excision or gastroenterostomy.

[Even in late cases it seems likely that irrigation does more harm than good, because it is likely to open up spaces which Nature has been successful in excluding, and it is quite impossible to secure a removal of all the intestinal contents which have escaped through the perforation.—ED.]

Two *acute perforating gastric ulcers* were successfully operated on at an army camp, by E. Huntley.[9] I. Age 49, history of indigestion for years. Symptoms developed soon after supper. Immediate operation disclosed fair-sized perforation close to pylorus. II. Age 28, similar history, operated on about 3 hours after onset. Perforation much larger, lower down and more indurated. In neither was the abdomen irrigated after closing the perforation, the fluid merely mopped away.

Another successful suture, apparently due to speedy operation, although the man was 83, is narrated by H. H. Brown.[1] At operation a perforation was immediately evident on ant. surface of duodenum close to pylorus. The edges were indurated, and apparently the ulcer was of some standing. It was closed with two layers of sutures, and post. gastrojejunostomy performed. A pint of food was introduced into jejunum before first row was completed. A tube was left in wound, extending to the ulcer, but was removed in 48 hours. He started feeding with peptonized milk within 24 hours.

Based on a study of *67 perforated gastric and duodenal ulcers,* H. M. Richter[2] offers the following suggestions: 1. The peritonitis resulting from a gastric or duodenal perforation is but slightly if at all infective during the first hours and, therefore, must not be treated as a suppurative process. 2. The degree of patency of the pylorus after closure of the perforation alone does

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(9) British Med. Jour., July 12, 1919.

(1) Ibid., Aug. 2, 1919.

(2) Surg., Gynecol. and Obstet., April, 1919.

not determine the indication or otherwise for a gastroenterostomy. 3. The technic, quite irrespective of the method, determines in a high degree, the mortality.

It is said to be difficult at times to find the perforation, and it has been suggested (1919 volume, p. 410) to give methyl blue to facilitate locating it. In three cases among the 50 in Cook Co. Hospital it is noted the perforation was not found during operation. Richter had no experience of this kind, and thinks it likely that a free exposure would practically obviate its occurrence. Upon locating the perforation, if leaking, a finger should be placed upon it until a through-and-through running suture can whip it in. The perforation and the ulcer, of which it is a small part, should now be thoroughly infolded with as many sutures as required. When the perforation lies close to pylorus and the induration is wide, it may be desirable to turn the first portion of duodenum acutely upon the stomach and suture it there. The essential step at this part is to bring good broad peritoneal surfaces together. Fowler's position, nothing by mouth, and large quantities of water per rectum constitute an important part of the after-treatment.

Of the 17 cases personally operated upon drainage was instituted in 6 or 7, being used in all of the earlier cases. In all but one instance drainage was through an extra suprapubic incision. In one drainage was carried down to perforation itself, which opened up within 48 hours and all stomach contents were discharged almost as quickly as swallowed. The patient died within a few days, the only operative death in 16 consecutive cases. In one where not instituted a subphrenic abscess formed, followed by a pleural empyema. This patient died in 4th week following operation, after making a prompt primary recovery. The extension to the pleura was probably due to inadequate drainage of the subphrenic abscess. The 17th case died of a generalized peritonitis. Necropsy showed 7 active gastric ulcers.

Hour-glass Stomach. For many years bilocular stomachs were objects of interest in the dead-house and in the museum. Anatomists regarded a double stomach as an attempted return to the multilocular stomach of ruminants. With the dawn of gastric surgery men recognized that double stomachs were common, and produced by disease. We all believe that bilocular stomachs are due to the slow contraction of the walls in the immediate vicinity of a chronic ulcer, but are not unanimous as to the best method of dealing with it surgically.

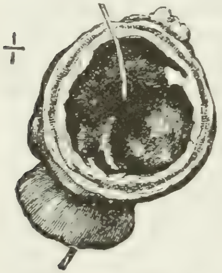

Fig. 124. The isthmus of a double stomach: natural size. (Bland-Sutton).

Many examples under Sir J. B. Sutton's[4] care have been treated by joining a loop of jejunum to the proximal compartment of the double stomach. In 3 instances he met with a stomach divided by a tubular isthmus so narrow that the desire to excise the isthmus and join the opposite halves was irresistible. The immediate results in each were excellent. The patients were women; were able to take food freely and painlessly, and quickly increased in weight. Within a year their troubles returned, with all the symptoms of a contracted pylorus. In each instance he reopened the abdomen and found the stomach so contracted at the junction that gastrojejunostomy was necessary and successful. It seems as if the contraction at the site of the ulcer which originally divided the stomach continued after excision of the isthmus. He now performs gastrojejunostomy as a routine operation for bilocular stomach.

An apparently unique condition—*double hour-glass (trifid) stomach* was operated on by J. Burke.[5] A woman, aged 27, some 10 years previous had hematemesis, and gastric disturbances since. About 6 months before had severe pains in stomach from time to time for some 3 months. A noteworthy feature is the examination of the contents gives no indication as to the real pathologic condition, except that it is the contents of a benign state, but it is a contents which is ordinarily found

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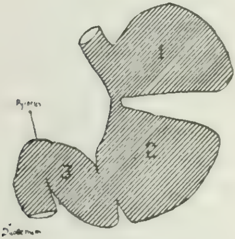
(4) Lancet, Nov. 30, 1918.
(5) Surg., Gynecol. and Obstet., July, 1919.

with a normal stomach. Without careful consideration of the history and without *x*-ray, accurate diagnosis would have been impossible.

Burke first made a posterior gastroenterostomy of the large middle pouch to the jejunum as close to the duodenojejunal angle as would permit him to handle the middle pouch in the second stage of the operation.

To overcome the obstruction between the cardiac and middle pouches he did a gastro-gastrostomy, using clamps and suture in the same manner of gastroenterostomy, the direction of the anastomosis being vertical, the line of suture being the whole width of the stomach. At time of report able to eat anything.



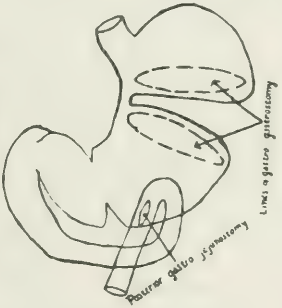


Fig. 125. Trifid (double hourglass) stomach.
Fig. 126. Operation for same (Burke).

Some *21 hour-glass stomachs* were operated on by V. Pauchet.[6] The methods were: Gastroplasty, 1; gastrogastrostomy, 2; mediogastric resection, 3; and pylorogastrectomy, 15. Two patients required re-operation, after pyloroplasty and gastrogastrostomy; in both secondary gastrectomy was done for functional troubles. The whole series was done under regional or spinal anesthesia, with 2 deaths—one with perigastric abscess, the other with a vast perforating ulcer. The only good end-results followed large resections.

The *surgical treatment of hour-glass stomach* practiced

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(6) Presse Méd., July 24, 1919.

by A. J. Walton[7] is described by him. Sometimes the ulceration is the chief factor, stenosis is slight, and there are no symptoms of obstruction. In such instances, the treatment is that of a simple ulcer on the lesser curvature. Where the stenosis is but slightly more marked, a similar plan will naturally be carried out, and it is indeed difficult to state at what stage of constriction treatment other than this is required. It seems wiser, even where there is marked constriction, to carry out the same procedure, but so to modify the excision that no narrowing of stomach results. On this line of argument, all later cases were treated with entire satisfaction. The actual steps are:

In every ulcer remote from pylorus, whether situated on post. surface or lesser curve which from its size is capable of excision, a clamp is placed obliquely across the stomach proximal to— and a second one distal to ulcer. The posterior blade of each is passed in turn through the gastrocolic omentum beneath stomach and out through gastrohepatic omentum. The ulcer, if adherent, is then freed from pancreas, no notice being taken of a perforation into stomach. A V-shaped portion of stomach containing the ulcer is now excised between the clamps. In no case has it ever been found necessary to perform a so-called transgastric excision. When the diseased area has been excised, the opening in stomach is closed. The posterior edges are first united by 2 rows of continuous catgut sutures. The first row commences at the apex of the V and, passing through the muscular and peritoneal coats alone, terminates at the lesser curve. The second row begins and ends at the same points but transfixes all 3 coats. The anterior edges are now united in a similar manner, the through-and-through layer being in this case inserted first. The incision must be so planned the sides of the V are at least as long as the diameter of the stomach. This can be accomplished by making them oblique, and, when the constriction is very marked, the upper limb of the V may terminate almost at the cardiac orifice. With a little care it will always be possible to make the limbs so long that, after they have been united, the lumen of

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(7) Surg., Gynecol. and Obstet., September, 1919.

stomach is at least 4.5 in. in diameter. At the same time every care is taken to preserve the band of normal mucosa forming the lower portion of the isthmus. The pylorus is now occluded and a post. gastroenterostomy performed. This is carried out in every case even if there is no trace of pyloric stenosis, for simple excision of an ulcer on the lesser curve is insufficient. The predisposing cause of the ulceration is not corrected, and a fresh ulcer is likely to develop at the line of suture. A gastroenterostomy alone is also insufficient, for, with an ulcer in this position, there is no pyloric spasm, and the contents will continue to pass through pylorus unless this be occluded. Walton's own experience, however, goes to show that permanent occlusion is unnecessary and, therefore, the canal is obstructed by a simple through-and-through mattress suture of silk, which is sufficient to occlude the lumen for 2 to 3 months. A posterior gastroenterostomy is then performed in the usual manner with clamps and 2 rows of catgut sutures, but instead of lying vertically it is made transversely, and is so placed its midpoint lies opposite the line of excision of the gastric ulcer. It is for this reason that every care must be taken to preserve the muçosa in the lower part of the isthmus. If a complete segmental gastrectomy had been performed, a post. gastroenterostomy could not be so placed without dividing the line of suture at the junction. By making the gastroenterostomy in this position of the usual length, namely, about 4 in., the possibility of constriction at the site of excision is guarded against, for, although it is unlikely that so wide a canal would ever narrow down, yet, even if it did, the gastroenterostomy would continue to drain both pyloric pouches.

The operation is simple, and not associated with any postoperative shock. In practice, it fulfills all requirements and is efficient. (Plate XXIX.)

Polyposis of the Stomach, a rare condition, is discussed by D. C. Balfour.(8) Its rarity is shown by the fact it was the first example in 60,000 abdominal sections at the Mayo Clinic (8,000 for gastric lesion). In addition, a correct diagnosis was made before operation.

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(8) Surg., Gynecol. and Obstet., May, 1919.

The patient, a man of 38, had had pain on an empty stomach for 3 years. The physical examination did not disclose any abnormal findings. There were no evidences of pulmonary lesion, and the Wassermann was negative. The test-meal showed an absence of free HCl and the presence of considerable epithelium. This achylia explained in a measure the symptoms, and considered with the character of the gastric pain and that it had been continuous over almost 3 years, practically excluded gastric or duodenal ulcer. The only clue was by *x*-ray examination. The entire pyloric end exhibited a diffuse mottled appearance, apparently well demarcated both at pylorus, and about 4 in. away. Carman, after a re-ray, at which any possibility of having taken food was excluded, made a diagnosis of polyposis.

At operation the stomach was found normal in appearance; on palpation, however, a soft, doughy thickening extending from pylorus to about 5 in. above was immediately evident, and although this did not give the sensation of an actual tumor, the lines of demarcation were quite definite and corresponded with those in roentgenograph. Resection was carried out along these lines. about ⅖ stomach removed. Immediate examination of tumor showed a most typical example of gastric polyposis. Examination of mucosa showed the polypoid changes did not entirely cease at the line of resection, and small globular masses were present at various points, particularly along the rugæ, which in turn were very markedly hypertrophied. This finding created some uncertainty as to the ultimate result, but the removal of the greater portion of the diseased tissue it is hoped will have a curative effect on the isolated tumors not removed. Satisfactory recovery. (Plate XXX.)

Carcinoma. Details of a case of gastric cancer are given by G. M. Todd[9] to show *the difficulties of diagnosis:* A man, of 45, had been well until 4 months previous to the time when seen. His symptoms were pain in the stomach, following eating. Persistent sour stomach, vomiting of blood. Three pints of fluid were lavaged at the first examination, 6 hours *p. c.* Ewald test meal

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(9) Jour. Michigan State Med. Soc., June, 1919.

showed HCl in excess and the absence of other chemical substances indicating cancer. X-ray meal, marked outward filling defect. History, physical examination, laboratory findings, *x*-ray, all pointed to ulcer. Operation, no adhesions, great thickening of pylorus with stenosis. Wide excision, posterior gastroenterostomy. Microscopic diagnosis, adenocarcinoma. To those who advocate extended medical treatment for ulcer, Todd commends the careful consideration of this case. This man is well and happy today.

The operability of carcinoma as determined by the x-ray, is discussed by R. D. Carman.[1] He believes its only decisive value is its prevention of operation in inoperable cases. Its value in the borderline cases is limited to preoperative information with regard to the location and extent of the growth, and their significance for malignancy. In the first group, which includes the highest percentage of operable cases, the *x*-ray diagnosis of operable so far as the stomach is concerned can be almost 100 per cent. diagnostically correct, while operability determined by metastatic conditions dwindles to about 50. As the likelihood of metastasis and spread seem to increase with the age of the disease, it is obvious many more patients could be successfully operated on if a diagnosis were made early.

Four cases of *perforating cancer of the stomach* have come under observation by Friedenwald and McGlannan.[2] These are much rarer than in ulcer. In the 1000 cases of cancer published by the former (1915 volume, p. 374) while 23 had signs of such perforation, in but 3 was it demonstrated.

Their experience is that chronic perforation indicates an inoperable lesion, and of the 4 cases only 1 was chronic. The patients (3 males, 1 female), were aged respectively 62, 57, 53 and 73. Death ensued in few hours to 3 days.

C. H. Mayo[3] discussing *the surgical treatment of gastric cancer,* tells us from Oct. 1, 1897, to Jan. 1, 1919, the Mayos performed 2094 operations. Some 736 re-

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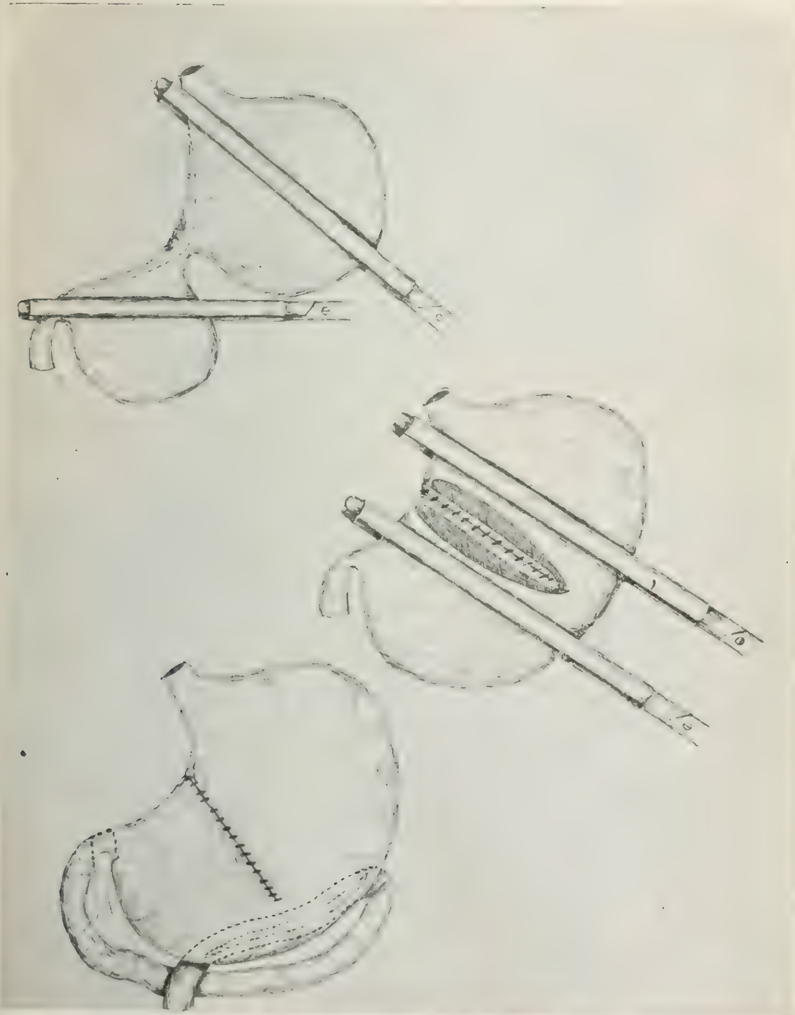
(1) Jour. Amer. Med. Ass'n. Nov. 15, 1919.
(2) Amer. Jour. Med. Sci., January, 1919.
(3) Annals of Surg., September, 1919.

sections with a mortality of 13.7 per cent., 746 explorations (2.9 per cent.) and 612 palliative operations (11.1 per cent.). The common type of operation was the Mikulicz, Hartmann, Billroth II, of which there were 359, with a mortality of 12.5 per cent. There were 19 of the Billroth I type (5 per cent.), 28 sleeve resections and 7 Kocher operations (14.2 per cent. each), 115 posterior Polya operations (14.7 per cent.), and 120 anterior Polyas (13.3 per cent.). The local resections, 12 in number, gave the highest mortality, 25 per cent. The Billroth I operation consists of a resection of pyloric end of stomach, and suturing of the duodenum to the partially closed distal end of the remaining portion. Since the Y-shaped line of suture of this type of operation frequently leaked with fatal results, Billroth, with Mikulicz and Hartmann, developed the so-called Billroth II operation, which consisted of completely closing the end of the stomach and making a post. gastrojejunostomy. The Kocher operation avoids the leakage of the Billroth I by attaching the end of duodenum through an opening in post. wall after the open end is closed, but tension here occasionally gave obstructive trouble or leakage. Polya avoided the double operation of closure of the end of the stomach followed by gastroenterostomy, by uniting, retrocolic, the whole open end of stomach to an equal sized opening made in jejunum.

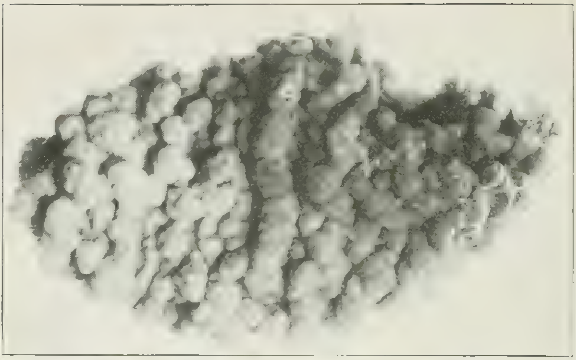
For 3 years the Mayos have been doing the ant. Polya, the original Krönlein instead of the posterior, bringing the loop of jejunum over the transverse colon. They abandoned the post. Polya because of primary obstructive complications due to adhesions, to tension from gastric traction, or to late trouble from recurrence of the malignancy, with early obstruction. The ant. operation gives an easier convalescence on the average. Better after-results are secured by turning the bowel to the right, isoperistaltic, which was a marked feature in the ant. gastroenterostomy. The point of attachment of the jejunum is approximately 14 in. from its origin, while the opening in the stomach comes directly over the descending leg of its loop, the reverse of the Mikulicz partial closure and button anastomosis. The transverse colon naturally sags in its midportion; by turning the

PLATE XXIX.

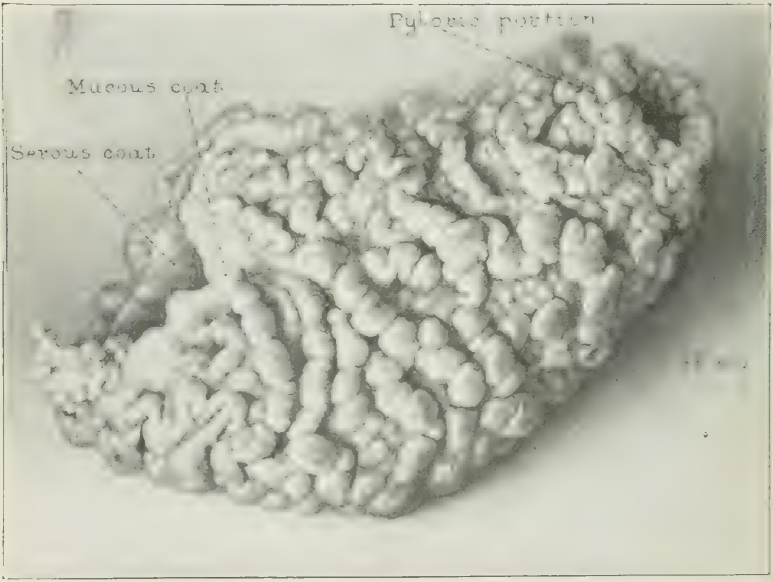


Operation for hourglass stomach (Upper left hand). Clamps placed obliquely across stomach. Amount of wall to be excised shown by dotted lines. (Right hand) Clamps placed parallel. Suture of opening commenced; posterior seromuscular layer passed. (Left lower) Opening completely closed. Posterior gastroenterostomy with horizontal opening performed. Silk suture passed ready to occlude pylorus but not tied. Walton. (See p. 411.)

PLATE XXX.



Polyposis of stomach. Photograph of specimen.



Same. Drawing of stomach turned inside out. Balfour. (See p. 413.)

bowel from left to right it is brought to the l. of the centre, while the stomach delivers along its lesser curvature, the more fixed portion of the viscus. Inasmuch as the tissues of the stomach are more or less devitalized by disease and more so by the operation, the suture material recommended is silk for the outer row and chromic gut for the inner row; the silk guards against separation from delayed healing. The completed operation can be made within an hour.

Their data bring the results of operation up to Sept. 1, 1917; some 427 operated on during the three years previous to September, 1917. Those who died in hospital, and those not heard from, number 121. Those who recovered and have been heard from number 306; 115 (37.6 per cent.) of these show 3-year cures. Some 313 operated on during more than five years before Sept. 1, 1917. Those who died in hospital, and those not heard from, 79. Those who recovered and have been heard from, 234; 59 (25 per cent.) of these show 5-year cures. This is a most satisfactory showing.

The end-result of an operation for carcinoma is given by J. Douglas:[4] A woman, aged 71, had a history of gastric disturbance, pain, and epigastric distress for several months, with progressive weakness and loss of flesh. Recently, vomiting had been so persistent that little nourishment was retained. Physical examination showed an indefinite mass in the epigastric region. No gastric analysis was made. X-ray demonstrated a carcinoma of pylorus with marked retention of the bismuth meal.

Operation, Sept. 12, 1912, and about a third of stomach resected by Billroth II method. Nodes not involved. Dec. 1, 1917, patient is in fair health, although over 76. She has symptoms of arteriosclerosis, but no gastric disturbances or signs of recurrence. Although the patient may be emaciated and weakened as a result of the pyloric obstruction, in the absence of metastases, age is not necessarily a contraindication to a radical operation.

Duodenum. Speaking at the Chicago Medical Society on the *surgery of the duodenum*, A. J. Ochsner[5] stated that embryologically the duodenum is a part of

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(4) Surg., Gynecol. and Obstet., January, 1919.
(5) Bull. Chicago Med. Soc., Oct. 18, 1919.

the stomach because, together they develop from the foregut. The stomach acts as a storage apparatus and a mixing and grinding apparatus; then it delivers what it contains to the duodenum and this continues to serve as a mixing apparatus for mixing bile and pancreatic juice with the food. Many years ago (1907 volume, p. 374) he observed the fact there was a thickening of the circular muscles of the duodenum below the entrance of the common duct, which seemed to hold the food while being mixed with bile and pancreatic juice, forming a kind of sphincter which could usually be observed in the passing of barium meals through this organ.

There was one marked difference between the duodenum and stomach; namely, that in the stomach ulcer degenerates readily into carcinoma, while in the duodenum this almost never occurs. There are many theories explaining this; first, the presence of acid on the stomach side, presence of trauma and of stasis, presence of hot food, presence of infected food, all of which are absent on the duodenal side. Duodenal ulcer is more common than gastric. The diagnosis is based on hunger pain, pain on pressure over the duodenum, referred pain to the right side of the back, minute quantities of blood in the feces and the history of cutaneous burns. The diagnosis should be confirmed by fluoroscopic examination.

The treatment consists principally of excision when possible, gastroenterostomy as a rule. This should always be made at the very lowest point of the stomach and always as near pylorus as possible, still remaining at the lowest point. Dietary treatment should be tried out first.

In the discussion A. Strauss said a proper pyloric closure accomplished everything that the medical man tried to accomplish with his treatment and the operation did not take over 10 or 15 min. There were no bad aftereffects for it did away with the regurgitation of bile and the terrific vomiting, and it was not necessary to have dietary treatment. He had operated a fairly large number in the past 5 years with his pyloric closure and there was certainly a difference in the results obtained as compared with those with the open pylorus. There had been no pain and no need of medical treatment, of great advantage from the economic standpoint.

To this Ochsner replied, he had closed a good many of them, as Strauss recommended, had talked the matter over with other surgeons, and his impression was that the difference was not very great. Following operation the patients could have a reasonable diet without any trouble, but he was sure some of Strauss' patients who ate anything would have trouble sooner or later, and that he would change his views in that respect.

A series of 3 successful *duodenotomies for foreign bodies* is related by W. H. Fisher:[6] I. Boy, of 3, swallowed a hairpin 3 days previously. X-ray showed it fixed in 3d portion, one end of the sharp point having become bent at acute angle and penetrated mucosa.

II. Boy, aged 15½ months, a week before swallowed a large "basting thread remover," with a sharp point, which penetrated the post. wall.

III. Girl, of 13 months, swallowed a "beauty pin" ⅞ in. long about 2 hours before being seen (Sept. 3). Fluoroscope showed it in stomach. Two days later it was in 2d portion of duodenum diagonally. The child was examined at intervals until Sept. 12, when a small barium meal was given, as the body of the pin was vertical. Fisher was of the opinion the pin had punctured the bowel. This was definitely proven by the meal. Operation was refused and child seen Oct. 8, Nov. 6, and again on Nov. 23. At each of these pin was found in same location. Operation was then consented to and a last examination was made Dec. 7, just before operation, to make certain it had not become dislodged. The pin had attempted to leave stomach point first in an almost straight position, but the point became engaged with the wall of the duodenum which was too small to allow the hinged portion to pass down and close the pin. It was only as the point penetrated the wall that the body of pin worked down (peristalsis) and came to rest when the pin was entirely through gut with hinge in contact with its inner wall, here food passing through failed to move it.

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(6) Annals of Surg., October, 1919.

INTESTINAL SURGERY—GENERAL.

At the Mayo Clinic 11 cases of *torsion of the appendices epiploicæ* have been met with, and are detailed by V. C. Hunt.[9] (*A*) True intraabdominal torsion, 7 cases, in patients of 29, 37, 43, 58, 63, and 70; (*B*) Foreign body, 1 case, woman of 42; (*C*) In hernial sacs, 2 cases, ages 51 and 63; (*D*) Producing obstructions, 1 case, male, of 57.

[The extensive bibliography contains no mention of the 2 well-marked cases of Hektoen (1891), in which they formed foreign bodies.—Ed.]

A new sign of fecal impaction is alluded to by R. Finochietto.[1] The two in use are: (*A*) A depression which the palpating finger leaves if the impaction is soft. This is not common. (*B*) The Gersuny symptom elicited by pressing upon mass then suddenly relieving the pressure. The sign is a feeling as if two wet surfaces were separated the moment the pressure is released.

The one referred to by Finochietto is the auditory translation of *B*. Over the chosen area the funnel-shaped end of a French stethoscope is applied. Over the shell end firmly is applied the ear, holding the instrument lightly with the fingers. The abdominal wall is depressed (.4 to 1.6 in.) with the stethoscope, and then the pressure is suddenly released. During the withdrawal of the stethoscope is heard a large moist râle if the sign is positive. Sometimes this is heard not only during the release of pressure but also during its application. Sometimes it is necessary to change frequently the place of the funnel in looking for this sign before it is found. Until the present time he has found the sign positive in every patient with fecal impaction. These crepitations are found much more easily than *A*. or *B*. If they persist after evacuation of the bowels, it indicates that evacuation was not complete.

Technic. An experimental study of *detached omental grafts in intestinal surgery* has been made by Finton and Peet.[2] The object was to determine: (1) What became of free grafts on the intestine under sterile and

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(9) Annals of Surg., January, 1919.
(1) Surg., Gynecol. and Obstet., September, 1919.
(2) Ibid.

under septic conditions. (2) The size, thickness, and vascular condition of the graft which would insure the best vitality. (3) The preferable method of its application to insure its vitality and prevent displacement. (4) A method to prevent adhesions from adjacent intestines and omentum to the free graft. (5) In what conditions would free omental grafts be justified, or necessary.

They conclude that detached omental grafts are preferable to fixed grafts except in the presence of general infection. They may be used on any abdominal organ. The indications are to replace lost portions of peritoneum; strengthen suture lines; prevent adhesions; check hemorrhages; occlude the pylorus; cover the stump of the cystic duct or Fallopian tube; and reinforce the peritoneum in threatened perforations. The technic is simple and may be performed with little trauma and in a minimum time. In the absence of infection the thin graft survives at least 6 months practically unchanged. The piece removed should be on the free border of the great omentum. The latter should not be markedly puckered and the cut edges should be covered. The graft must be thin, spread out carefully over the injured part, the cut edge rolled under, and fastened by several fine silk sutures. (Plate XXXI).

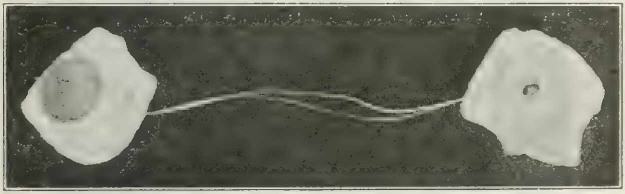

Fig. 127. "Good" tension suture (Thigpen).

In the *"good tension suture"* introduced by R. H. Thigpen[4] there are employed one or more strands of silkworm gut; small gauze sponges; 2 metal buttons, each the size of a 25-cent piece, and perforated at its center with a $\frac{1}{16}$-inch hole, and 2 or more perforated shot. The sponge, button and shot holding each end of intestine are placed a suitable distance from the line of incision, and tightened to secure the desired approximation. There occurs a pronounced ridge along the line of incision. The ends of the absorbable subcuticular suture of skin are treated as are the tension sutures.

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(4) Jour. Amer. Med. Ass'n., Feb. 15, 1919.

A *cofferdam intestinal retractor*, advised by R. M. Harbin,[5] is inexpensive, and made in a truncated cone by sewing a section of stocking around pliable copper rings. A dozen different sizes will be found useful in the isolation of infected areas, reaching inaccessible sources of hemorrhage and facilitating suturing without heavy packing and in searching for lesions causing obstruction.

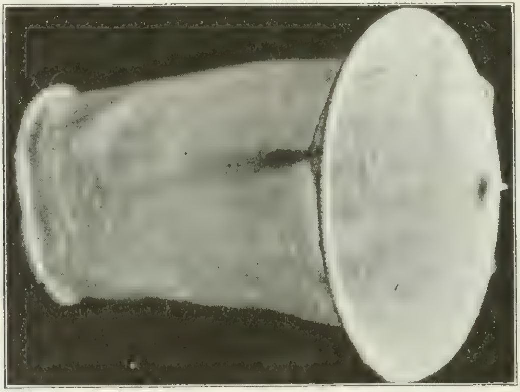

Fig. 128. Cofferdam intestinal retractor (Harbin).

A simple method of *excluding the septic end of the bowel during resection* is described by R. E. Farr.[6] Numerous methods have been devised for protecting the peritoneal cavity from contamination. The remaining ends of the bowel may be sterilized by cauterization or inverted, and the same treatment may be accorded the portion to be excised, but this takes time. For the method recommended the materials are always at hand, and the septic bowel may be excluded in an instant after its division without the slightest contamination.

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(5) Jour. Amer. Med. Ass'n., May 31, 1919.
(6) Surg., Gynecol. and Obstet., March, 1919.

At the first point of division a heavy clamp is placed upon the portion which is to remain, while the portion to be excised is grasped by a long-handled forceps, the blades of which have been inserted into two fingers of a sterilized glove. After the division by knife, scissors, or cautery, the end that is to remain may be treated in the usual manner. The end which is to be removed is held in the forceps, as illustrated; the operator then grasps the glove at point *C* with his left hand, and his assistant grasps the glove at points *A* and *B*. By making traction, the sleeve of the glove assumes a triangular form, second figure; the septic end is then made to disappear by making traction upon the forceps, the glove being turned inside out over the bowel and there securely clamped by means of a forceps. Also in many other operations where a septic mass with a pedicle is to be isolated.

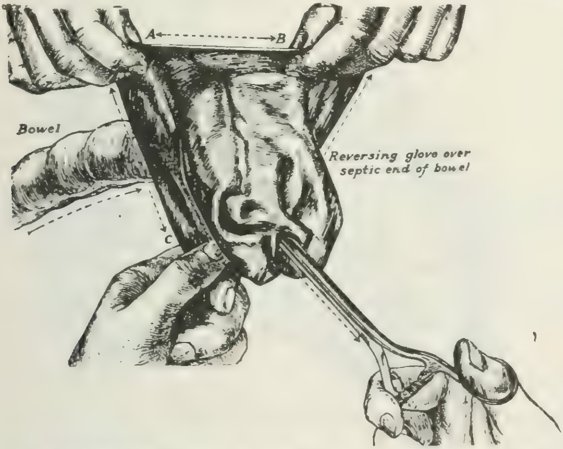

Fig. 129. Exclusion of septic end of bowel during resection (Farr)

Why is end-to-end anastomosis unsafe? asks A. L. Soresi.[7] He answers by stating the tissues found in the mesenteric spaces (angles) are infected and their blood supply is practically nil, that in order to make it as safe as possible whatever can lessen the resistance of the tis-

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(7) Annals of Surg., June, 1919.

sues concerned in the anastomosis must be avoided, such as unnecessary traumata, blood-clots, great amount of suturing material, unnecessary infection,. knots, tight sutures; the blood supply must be left in the best condition obtainable with a safe and perfect hemostasis; all these are obtained with the technic recommended.

When shall end-to-end anastomosis be employed in preference to side or oblique methods? The answer depends on the good judgment of the surgeon, who has to be guided by the following considerations, which seem very reasonable: Given as basis for the considerations which have to guide the surgeon, that the same surgeon is really master of the technic of surgery of the intestine, technically speaking there is no doubt the end-to-end is the most rapid of all methods by which anastomosis can be obtained. *It follows the end-to-end method should always be resorted to in preference to any other requiring more time, when, and only when, time is the most important factor that will help to save life. I. e.*, given a patient whose probability of withstanding the resection and consequent anastomosis depends on the rapidity by which the whole operation is performed, so that few min. might have a great influence on the probabilities of recovery, it is more reasonable to perform an end-to-end anastomosis than any other method requiring more time. Supposing

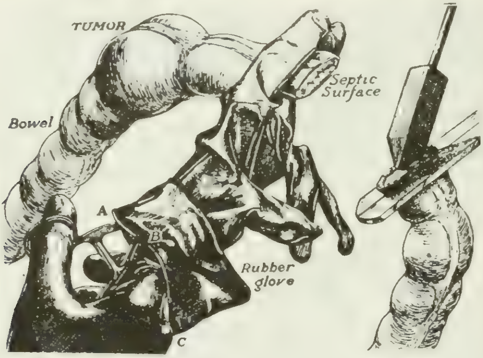

Fig. 130. Same. (Farr).

the danger of losing the patient through leakage into the abdominal cavity is 3 or 4 per cent. and the probabilities of losing the patient because the operation has required a longer time are 10 or 15 per cent., we give the patient the most favorable percentage, and the surgeon shall be guided by his own judgment in every particular case.

Four successful *double resections of the bowel* are recorded by G. Taylor.[8] All during the War. The pulse in 3 was 126 and over when the patient came to operation; the pulse in 4th was slower until the wound was enlarged. In Case 1 operation was performed five hours after the patient was hit; in Cases 2 and 3 after six hours, and in Case 4 eight and a half hours had elapsed.

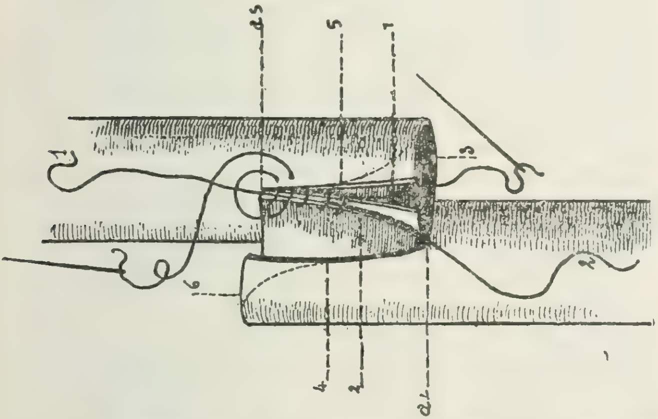

Fig. 131. Disposition of the segments of gut for oblique anastomosis, recommended. Dotted lines show how angles can be rounded to make the anastomosis more even. In performing the oblique anastomosis borders 1 and 2 are sewn together, border 3 is sewn to border 4 and to part of border 6, border 5 to the portion left unsewn of border 6, so the two segments of the gut overlap each other, the anastomosis is oblique and the point where anastomosed almost double the lumen of intestine; this will prevent any possible dangerous stenosis (Soresi).

He performed only one triple resection; the patient was desperately wounded, and it was found necessary to resect 24 in. of upper jejunum, 4½ of transverse colon, and the sigmoid. In addition there was a severe wound

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(8) Lancet, March 22, 1919.

of the liver and gallbladder. Transfusion was carried out, but he died 24 hours later.

Taylor believes the high mortality of double resection in war has been due to the serious injuries, and is unconnected with the operation itself. In no successful case of his own was the postoperative history characterized by any intestinal obstructive phenomenon, nor was any such demonstrable at necropsy. Probably his successful cases owe most to their own marvelous recuperative powers, and to the devoted attentions of the nursing sisters.

Surgery of Large Bowel. In considering the *development of colon surgery*, E. R. McGuire[2] states his personal cases have been 28, excluding minor procedures, as cecoplication, division of bands, etc. There were 4 short-circuiting operations, with 2 deaths from intestinal obstruction, leaving 24 resections. Of these 8 were for carcinoma: cecum 2, desc. colon 5, sigmoid 1. There were two deaths—both in old people—with evidence of uremia, being in coma and passing no urine. This leaves 16 cases of marked stasis with partial obstruction. There were 2 deaths, one from hemorrhage and the other—on 22d day—from pulmonary embolus.

In the early cases done for stasis, where obstruction was not marked, relief was only partial; and the operation of doubtful expediency. However, where giant colons were present, where extensive postoperative adhesions produced obstruction—shown by dilatation—the relief was marked. The obstipation and associated pain disappear, and the results are in every way satisfactory. He has come to the conclusion that the operation for stasis is indicated only in presence of definite obstruction. When indicated, the operation of choice is resection, by end-to-end anastomosis to avoid a diverticulum.

J. Okinczyc[3] gives some *general considerations on surgery of the large bowel:* He starts with the statement the colon has characteristics that distinguish it from the stomach and the small bowel. One of these is the thinness of the wall, which during operation calls for special precautions. The needles and sutures must be much smaller, both must be particularly small. Again, for

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(2) New York Med. Jour., Jan. 25, 1919.
(3) Presse Méd., Oct. 11, 1919.

anastomoses, the stoma should be made along one of the muscular bands (taenia) where the thickness is greater.

A second point is the vascular supply is not so rich, and we find no series of anastomosing arches as in the small gut. The only approach to this is found at the hepatic and splenic flexures and more marked at the sigmoid. Hence the arteries of colon are almost or quite terminal in nature, less favorable for anastomoses. Therefore when choosing a point for section or suture, it should be close to one of the principal colic branches.

Partial absence of mobility is the third characteristic of the large intestine. It is partly fixed to the post. parietal peritoneum. The guiding principle in all gastrointestinal surgery is that the anastomosis, resections, sutures, should be done *outside the abdomen.* This extra-abdominal technic is readily carried out for such segments of the colon as are mobile, *e. g.,* the transverse colon, sometimes the sigmoid, but the ascending and descending segments, fixed more or less, can only be freed by another incision in the mesocolon.

The other differences are of less importance, the presence of the appendices epiploicæ when large hinder suturing. The omentum, as well, when laden with fat offers considerable difficulty. Okinczyc and Lardennois have split it along the line of coalescence.

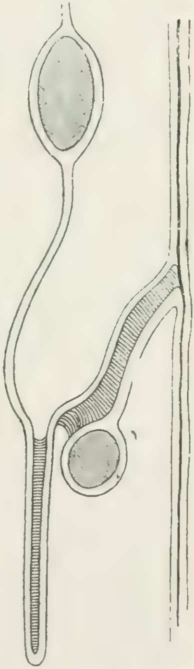

Fig. 132. Diagram showing plan of cleavage of omentum (Okinczyc).

The flora of the large bowel is very rich, hence to insure integrity of the sutures, especially those which close a divided end, application of iodin or alcohol can be used, but the thermocautery is preferable.

Owing to the consistence of the contents no mechanical aids, Murphy's button and the like, should be used in the l. half of the colon. Nor is the choice of anastomosis in-different. Side-to-side junction with both ends in a cul-de-sac, is but little favorable to good circulation of the fecal mass. While the lateral opening slowly tends to place itself in the long axis of bowel, this takes too long, and Okinczyc advises especially for l. half, end-to-end union, or rarely—end-to-side.

The author insists on the importance of the ileocecal valve. While usually looked on as of uncertain use, habitually insufficient, and certain methods have been devised with the theoretic affirmation it is useless to prevent all reflux towards the small bowel. However, personal investigations, clinical observations controlled by necropsy findings, as well as certain facts of intestinal surgery, have convinced him of the often efficacious—and always indispensable—rôle of this valve. He believes also that the normal antiperistalsis of the large bowel is arrested physiologically and mechanically at the valve, which opposes any reflux of feces and gas (especially the gas) towards the small bowel.

Okinczyc states he has seen a few individuals literally martyrized by the gaseous reflux and distension of the small gut. They were patients who had undergone total colectomy followed by ileocolostomy. The distension was apparent under the wall at the time of the painful crises, was accompanied by spasms, violent contractures; all ending suddenly by spontaneous escape of gas per anum. If he had to choose between two anastomoses (*A*) ileosigmoidostomy, *c. g.*, creating an ileocolic continuity without the interposition of the valve; the other (*B*) leaving the valve intact, he would in lack of any special indication, select the latter. This has been used especially by Lardennois, who calls it "subcecal colectomy."

Colostomy. W. E. Sistrunk(5) offers some practical considerations with regard to *permanent colostomies*. Nearly every type that has been suggested and seemed practical has been used in the Mayo Clinic, but up to the present, operations undertaken with an idea of giving control of the passages have almost always proved disappointing. Until recently they made the majority of colostomies through an oblique, muscle-splitting incision in l. inguinal region. The loop brought up for the colostomy was supported by a glass rod, rubber tube, piece of skin or silkworm sutures, and was cut across 5 or 6 days later. Many of the colostomies in this manner were perfectly satisfactory. In a few there was a tendency toward the development of a ventral hernia into the tissues surrounding the colostomy. More frequently, however, the tendency has been toward a retraction of the loop of bowel in which the colostomy was made, allowing in some instances, the proximal end of the bowel to discharge a part of its contents into the distal end. They are now making a colostomy very similar to the one described by Mixter. As a rule this colostomy is made through a straight incision placed below and about 1 in. to l. of umbilicus. An incision of this type possesses distinct advantages. Through it a thorough exploration of abdomen may be made. If found necessary, a primary resection is possible, or, the first stage of the three-stage Mikulicz operation can be done. The incision may be extended in either direction, and if, after the exploration, it is decided to make a colostomy, this is done through the center or upper end of incision.

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(5) Surg., Gynecol. and Obstet., June, 1919.

The colostomy is made in a loop of the sigmoid, because of its extreme mobility and the length of its mesentery. After the loop has been lifted out, an incision 1.5 to 2 in. long is made through mesentery, parallel to the vessels, and extending up nearly to bowel. A second incision, about 1 in. long, is then made across the end of first incision quite near the mesenteric attachment. Two strips of gauze are placed in the upper end of this T-incision and when these are pulled apart a good sized opening through the mesentery is created. The two sides of the entire abdominal wall near the center of abdominal incision are sutured through this opening in mesentery. The remaining portions of the incision are then closed; a small bite of the bowel is included in 2 of the sutures to prevent herniation of small intestine. When the gauze has been removed a glass rod or rubber tube is placed through the opening in the mesentery between the skin and bowel to serve later as a guide in cutting across the bowel.

If necessary for gas distension, a small opening may be made in the bowel any time after 24 to 48 hours, and in 5 to 6 days the bowel is cut across completely with the cautery. As a rule, however, the patients pass gases very readily through the knuckle which has been brought up, and it is unnecessary to disturb it before 5 or 6 days. After the loop has been cut across it will be found the ends of bowel are separated by the entire abdominal wall for from 1 to 1.5 in. and that the cut ends of bowel protrude for 1 or 2 in. above the skin. These may later be cut shorter if thought necessary. (Plates XXXII, XXXIII).

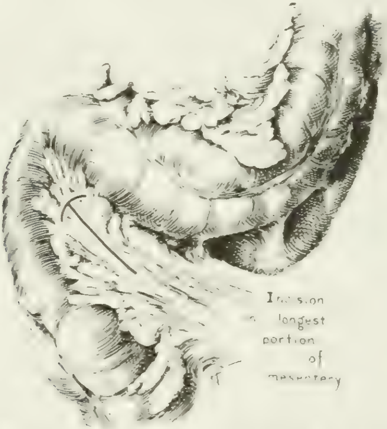

Fig 133. Sigmoid showing long mesocolon compared with short one above; also incision in mesentery when sigmoid is used for making a colostomy (Sistrunk).

Fistulæ. The *methods of closing fecal fistulæ* are enumerated by P. L. Mummery.[6] Such fistulæ may be classified as: 1. Temporary colostomies with a spur, the operation having been performed at the C. C. S. or a base for wounds of rectum or colon. 2. Cases where mucosa is adherent to the skin. The opening may be quite small but more frequently is large and accompanied by extensive prolapse. 3. In which a fibrous track or sinus connects the gut with the skin. 4. Where the gut opens into an abscess cavity connecting with the surface. 5. Cases complicated by compound fractures and hemorrhage.

It is obvious there can be no one technic applicable to

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(6) Surg., Gynecol. and Obstet., September, 1919.

all, but that frequently some special method will be required to suit the case. Nevertheless, there are certain principles which must always be observed if a good result is to be obtained. Fecal fistulæ are generally complicated by considerable excoriation around the opening, and in cecal or small gut fistulæ is particularly severe. The skin must be brought into as good a condition as possible or there will be little chance of success. For this purpose administer opium sufficient to cause considerable constipation and, where possible, solid stools. After a week or more, if carefully nursed and the skin protected by lanoline, a very marked improvement will have taken place. Previous to operation the bowel is cleared by enemata through the fistula and aperients are not used.

[By limiting the diet of patients suffering from severe excoriations of the skin, for two or three days to the whites of two eggs given at intervals of four hours, these excoriations will heal with amazing rapidity—especially if the fistula is in the small intestine. If in the large intestine, the treatment should be preceded by a large dose of castor oil and one or more cleansing enemas.—Ed.]

One of the important points is to open the abdomen to one side of, and well away from, fistulous opening. The exact method varies, but the principle is the same—to get into the abdominal cavity and then, with the parts well exposed, completely to free the gut and fistula in one piece. The involved parts can then be drawn out and the exact condition ascertained. As much of the involved portion of bowel is cut away as is necessary so as to leave quite healthy tissues which can be brought together. Sometimes this will involve the complete resection of several in. of bowel, but more frequently a large hole will be left which only requires careful suture. It is of great importance that the blood supply to that part of the wall which it is proposed to suture should be carefully preserved. The bowel should always be so cut that more wall is cut away at the free than at mesenteric side, even healthy bowel being removed if necessary. The cut edges which are to be joined should form roughly an angle of 45° with the mesenteric border. This makes certain that the stitches joining the ends on the mesenteric side do not cut off the supply to the joined edges on the free side (diagram). Lastly, the hole in bowel is sewed up with catgut through all the coats and this line is reinforced with a second catgut suture through serosa only. The abdominal wall is closed, and a small drain, preferably of rubber tissue, inserted down to the point of closure and brought out between 2 stitches. This can be removed in 36 hours. It is always advisable to have a drain, as of necessity there must be some infection by *B. coli.*

As regards after-treatment, Mummery's own practice is to insert a rectal tube at the operation and irrigate very gently with water through this twice daily for 2 or 3 days. No pressure is used, but the water is allowed to flow in and out again to wash the bowel and keep the tube clear. Liquid petroleum is given daily and small doses of magnesium sulphate each morning, beginning the day after operation. The object of this is to obtain liquid stools daily. Since using these methods he has had no failure to close the fistula, and very few without immediate primary union.

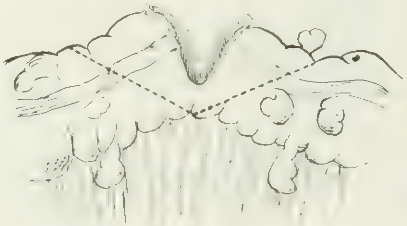

Fig. 134. Closure of fecal fistulæ, dotted lines show lines of excision (Mummery).

THE INTESTINES.

Injuries. G. Söderlund[9] discusses the clinical picture with intra- and retroperitoneal *subcutaneous rupture of bowel,* describing 16 cases of the former at Upsala or Gothenburg since 1910; also 37 of retroperitoneal rup-

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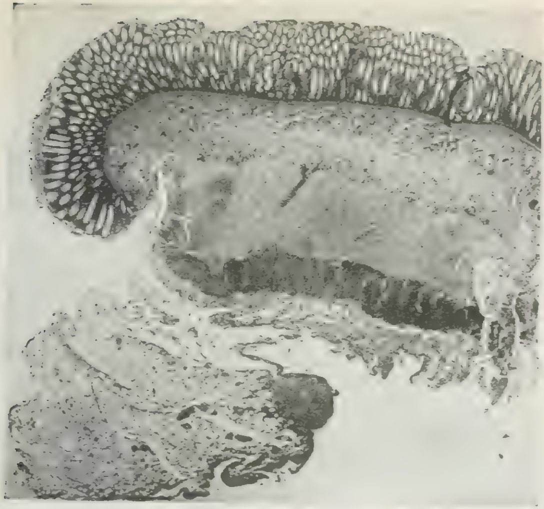
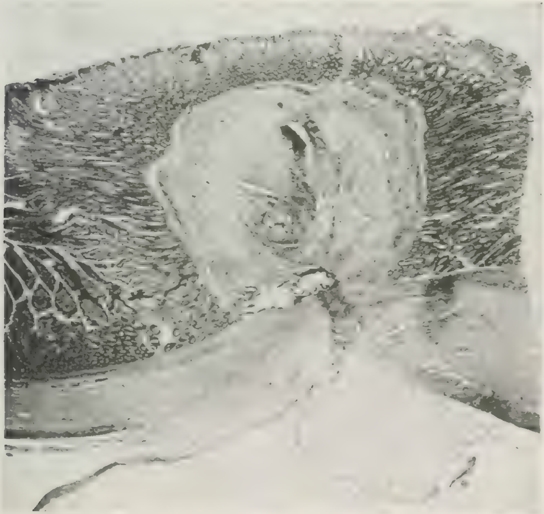
(9) Nord. Med. Arkiv (quoted in Jour. Amer. Med. Ass'n., May 3, 1919).

PLATE XXXI.

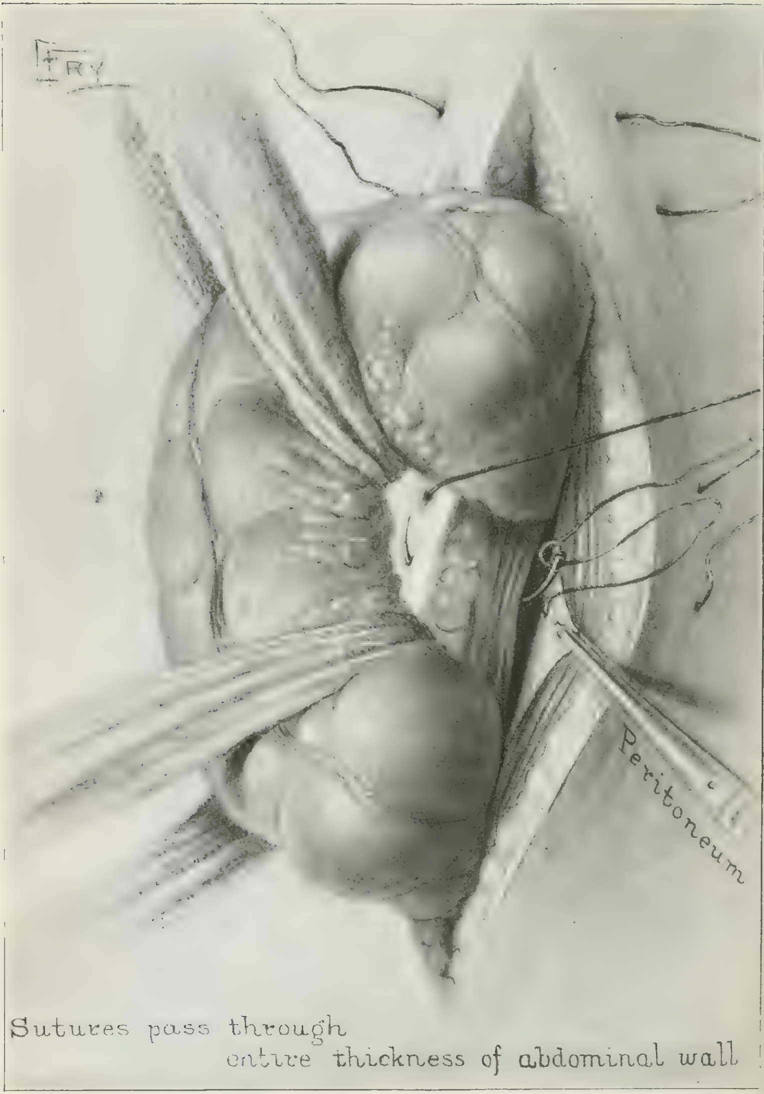


Free omental graft sutured over puncture in intestine, three months after operation. No closure other than with graft. Some infiltration and destruction of graft due to infection of inner layer by intestinal contents. Graft, however, survived and permanently closed opening.



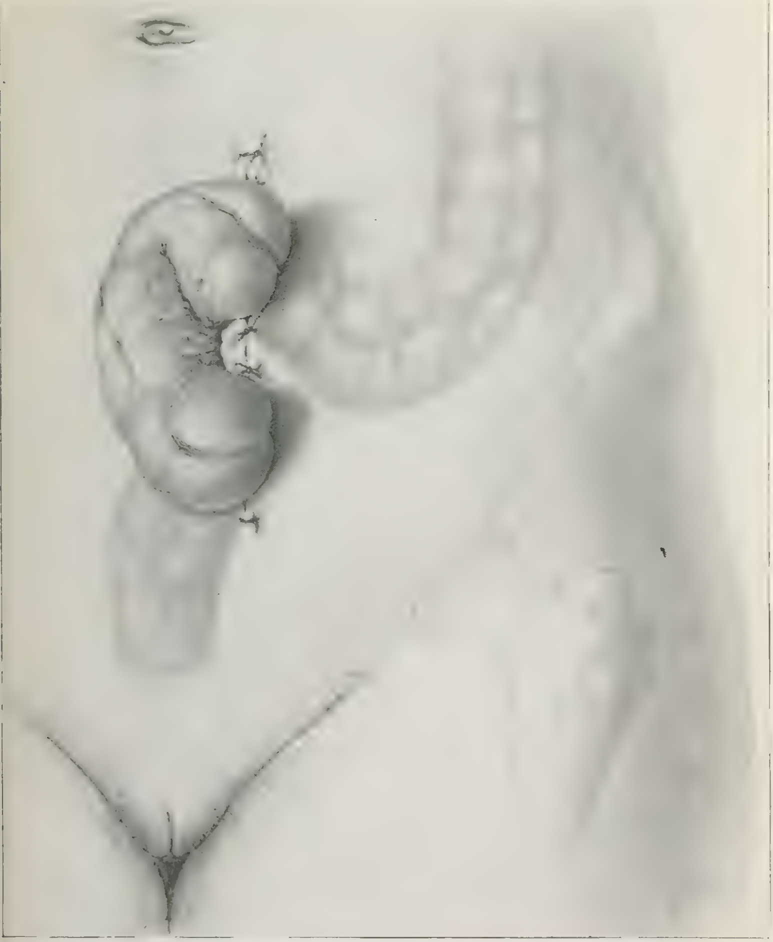
Three months after suturing free omental graft over end-to-end anastomosis. Silk suture still in place in intestine. Graft has survived practically unchanged; no adhesions. Finton Peet. (See p. 420.)

PLATE XXXII.



Edges of opening in mesosigmoid being held widely apart by gauze while a portion of wall is being closed through the opening. Sistrunk. (See p. 428.)

PLATE XXXIII.



Same. Unopened loop of bowel brought out for colostomy after abdominal incision has been completely closed. Sistrunk. (See p. 428.)

17 and 24 hours, the suture burst; resection might have saved these patients; both of the men lived a week. Catgut had been used, but necropsy showed it would have made no difference if done with silk.

E. G. Stanley[1] gives the details of 4 traumatic *ruptures without external lesion.* No. 1 died, the others recovered. In Cases 1 and 3 the moving body was the patient's own body and the velocity that due to gravity. In 2 and 4 the patient was struck by a moving body, in each case with considerable velocity, but probably not so great as in 1 and 3. It used to be taught that the most fixed part of intestine, being unable to escape the compressing force, was most frequently ruptured, but in actual fact the reverse holds. The most fixed parts are the duodenum and parts of the large intestine. Experience shows, however, that the most movable parts of the large gut—the cecum, the transverse- and pelvic colon—are the most frequently ruptured, in that order. The rectum is well protected from all but the most severe crushes. The duodenum is chiefly on inner side of the watershed formed by the vertebral column and is protected in that a compressing body from before back will meet the spine first; but this very protecting influence renders the transverse part the more liable to injury as it crosses the watershed. The duodenum is further protected by the ribs, by the liver, and by the colon which crosses it, and is thus fairly immune except in its 3d part. Far otherwise is it with the jejunum and ileum.

The coil nearest the wall at point struck is usually where rupture takes place, and in so far as the first few feet of jejunum and the last few of ileum before the valve are usually in this position they will tend to be injured. If the blow is above umbilicus the force is transmitted to the first few feet of jejunum. The mobility allows it to be pushed till it is checked ultimately by the vertebral column, and between the latter and the moving body it is ruptured. A parallel situation occurs at the ileo-cecal junction.

In Case 3 a small tear was found over the sacral promontory, the force having first ruptured the bladder and then crushed intestine against this prominence. In Case

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(1) Lancet, Oct. 25, 1919.

4 the jejunum was torn unusually close to the duodeno-jejunal flexure. An unusual feature of the cases is that in 2 other organs were ruptured at the same time.

In Case 1 it is not surprising that a spleen enlarged by malaria should be ruptured, but one would think its size would protect the intestine. Here a coil of jejunum must have lain in front of the enlarged spleen and have been driven into this organ, which, rupturing, allowed intestine to be torn against spine in the usual way. In Case 3 also another organ was ruptured. As it occurred at 2 A. M. it is reasonable to suppose that the bladder was fairly full. The tear in parietal peritoneum suggests the bladder was first ruptured against the promontory and then the ileum crushed at the same spot as the bladder.

As regards *the etiology* L. Lindop[2] believes in addition to those mentioned by Stanley, there are 2 other factors: (1) Hydrostatic pneumatic effect; (2) kink.

The small intestine contains fluid and gas, sometimes more, sometimes less. Any sudden violent compression applied to abdomen tends to force fluid and gas out of the coils in its way. This force, acting on fluid and gas in a tube, acts equally and in all directions, and at first tends to balloon the tube. If the ends are unobstructed the contents are forced, aided by the elastic recoil of the tube, in the direction of its length—path of least resistance. This goes on until contents, or pressure only if tube full, slams up against the kink where the resistance is absolute. The pressure, communicated in the case of a full tube, or actual movement of contents in one collapsed, accentuates the kink. The tube balloons and ruptures at its unsupported margin. A complete transverse rupture occurs in a tube full of fluid to which sudden pressure is applied. It slams against the kink (duodeno-jejunal flexure), as in the case described by Stanley. It is the *full* tube which causes the rupture. It will be argued that fluid and gas should go down as well as up. So they do. Some goes up and some goes down. But there is no kink below.

A small rent indicates gas and a large one fluid contents. Gas is compressible, but fluid, for the purposes of this tube, absolutely incompressible. In a full tube there is no actual movement of contents, only transmission of force. The duodenum ruptures above the duodenojejunal kink, and the ileum below. Any coil temporarily caught distended with gas and some fluid, and from this cause having a slight twist, supplies its own kink. It is already ballooned, and if sufficient force is applied it ruptures at its unsupported margin. Rupture is more serious in the upper part of this tube, as there is more fluid and less gas. Gas tends to remain in the stomach and not pass on. The effects of sudden pressure are much more smashing on a tube distended with fluid than with gas. In the lower intestine any distension is caused by gas and effects of sudden pressures are less noticeable, and there are no kinks, except at the ileo-cecal junction.

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(2) Lancet, Nov. 15, 1919.

Reporting a successful operation in a rupture of jejunum and laceration of mesentery, also without external lesions, W. H. Battle[3] states the special points to be remembered in the operation for suspected rupture are:

1. The incision should extend well above umbilicus, as this gives best access to the root of the mesentery, and permits of most rapid examination of the abdominal contents. If the rectus is temporarily displaced out and the post. layer of sheath divided well to the l. of midline (and it is best to place the whole incision to the left) there will be no danger of subsequent hernia.

2. Blood or fluid which has accumulated should be washed away with moist sponges and a search made for the source of bleeding. When hemorrhage has been arrested the damaged gut is looked for; this will usually be found in a line between the point struck and the spine. Before this is treated search should be made for a second point of rupture, for there is more than one in some 20%. Apparently lesions of the upper jejunum have proved difficult to find, for they have been overlooked in several instances, only to be revealed post-mortem. Ruptures of the duodenum give the most anxiety, because there is usually excessive shock causing delay in the operation, great difficulty in localizing the lesion, and when it is found more manipulation is needed to remedy the damage, the time thus required further imperiling success.

3. Treatment will depend upon the extent of damage

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(3) Ibid., July 19, 1919.

to bowel wall and mesentery. A large laceration may be clean edged and as safely secured with a double suture of silk or other material as those of smaller size, but if the damage to the wall is severe or there is another opening close to the one first discovered it may be necessary to resect and do anastomosis. The sutures will thus be placed in healthy tissue and valuable time saved. It is quite impossible to lay down hard-and-fast lines as to whether the laceration should be sutured, resected, etc., or not. Most recoveries, as would be expected, were after rapid suture. Murphy's button did not prove very satisfactory, partly because it was used by operators who were hurried by the critical state of their case. Temporary artificial anus in the small gut only when there is no time for anything beyond.

4. Closure of the abdominal incision may be effected in the majority without drainage of the peritoneum; if drainage is required a suprapubic stab will suffice, the tube being passed deeply into pelvis. The course followed should depend on the presence or absence of peritonitis and the possibility of cleansing the infected peritoneum. When in doubt drain and place in Fowler position. When drainage is established much benefit may be derived from proctoclysis during several hours.

Foreign Bodies. Details of a remarkable case are given by S. Mercadé,[4] a *hemostat retained in bowel for 12 years.* A woman, aged 63, had had herniotomy, and some gynecologic operation previous to that. The instrument was discovered accidentally, but no traces of any ill-effects were noticeable. One blade had been worn off by the action of the intestinal juices.

[See also La Roque's case—Bladder.—Ed.]

For years; when a *child has swallowed a fish hook,* open safety pin, pins, or any material apt to lodge in the intestinal tract, R. C. Faust[5] puts them on milk, bran and mucilaginous diet. Twice daily a large dose of olive oil followed with the official Seidlitz powder—dose in proportion to the size of child. If the stool is watched carefully for a few days, one will see results. Most of the time, the foreign substance is incorporated within a soap

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(4) Paris Méd., July 8, 1919.
(5) Jour. Amer. Med. Ass'n., Oct. 25, 1919.

ball; and in any event the little soap balls are just the right shape to bear the foreign substance on and out of the many folds of the mucosa.

[This is a variant of a plan used (for years also) in Great Britain, ingestion of large amounts of oatmeal porridge. In the U. S. the festive buckwheat cakes have been used as well. On one occasion shreds of absorbent cotton were successfully administered.

In a large number of cases we have successfully made use of a method said to have been introduced by London pickpockets who swallow articles of jewelry when in danger of being caught. This consists in placing the patient on an exclusive diet of mashed potatoes flavored with fresh cream, given every three hours until the object appears in the feces. It is interesting to follow the progress of the object with the x-ray.—ED.]

Perforation of the cecum by a pin occurred in a soldier seen by J. A. C. Macewen.[6] The man was admitted in extremis. Very little history was obtainable, save he had been ill for a week. Advanced general peritonitis was obvious. The abdomen was rapidly cleaned out, and the mischief immediately ascertained to be a pin in the cecum, the point of which had caused a perforation close to the base of appendix, through which it projected. It was removed and perforation closed by a stitch, but, in spite of every endeavor, the patient died shortly.

Ileus. The *early diagnosis of intestinal obstruction* is dealt on by R. Warren.[7] The records of the London Hospital show the following results for acute appendicitis and perforated gastric ulcer during two periods of a few years' duration, the first just after 1900, the second following 1914. The Fowler position came into general use about 1906:

	1900 and after.	1914 and after.
Acute appendicitis, mortality......	27 per cent.	6 per cent.
Perforated gastric ulcer, mortality.	66 per cent.	40 per cent.

In the case of obstruction, there is also an improvement, but much less notable, viz.:

	1900 and after.	1914 and after.
Obstruction mortality	50 per cent.	39 per cent.

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(6) Lancet, Nov. 1, 1919.
(7) Practitioner, September, 1919.

His own figures for a decade show practically the same figures, 153 cases, 56 deaths—34%. A closer examination shows clear reason for the heavy mortality:

1. Obstruction by bands and through apertures, 53 cases; 21 died, but of these in 12 it was necessary to resect gangrenous gut, and of these 66% died; while when resection was not needed, only 31% died.

II. Intussusception, 39 cases; 12 died, but of these 8 were resected for gangrene and only 1 lived; the mortality when reduction was possible was 16%.

The relative frequency was: Gall-stone, 1; stricture, 53; intussusception, 39; bands, 49; internal hernia, 4; volvulus, 9. Diagnosis of the various forms of obstruction from each other is often impossible without operation, nor is it of much importance, since, except for impacted feces, laparotomy is indicated in all cases.

1. *Gall-stones.*—The onset is sudden, the pain very great and definitely a colic, *i. e.*, remittent; vomiting is early and urgent; distension slight and late; the stone occasionally can be felt; in middle-aged and aged.

2. *Stenosis.*—The onset is gradual, often preceded by a form of dyspepsia. Vomiting is only urgent late and often fecal (these cases are commonly of the large intestine). Distension comes on gradually, and visible peristalsis is common. In middle and old age.

[In many of these cases there is a history of loss of weight, and also of previous attacks of obstruction lasting only a short time.—Ed.]

3. *Intussusception.*—The onset is sudden, usually in infants. Pain is great and paroxysmal. Vomiting usual at onset, and again late when the condition is bad. Collapse great. The passage of blood and mucus, and the elongate tumor, render diagnosis fairly easy.

4 and 5. *Snaring and Kinking.*—This group shows great variation in signs, for the obstruction may be high or low (usually small gut), and blocking may be very acute or develop gradually. Hence shock is uncertain. Vomiting urgent, if the block is high, less urgent and inclined to become fecal if low. Distension late, and there is sometimes the local distension of a small loop.

6. *Volvulus.*—Being low in the large intestine, vomiting slight as a rule. Shock considerable. Distension very rapid, and may be enormous.

The *treatment of acute gastromesenteric ileus,* is considered by A. P. Condon.[8] The one usually recommended is: Frequent lavage and postural methods with a view to altering the position of the intestines, thereby releasing the pull upon the mesentery. If these do not give relief then opening the abdomen and lifting intestines out of the pelvis and in some cases doing a duodenostomy or duodenojejunostomy. The postural methods, such as elevating the foot of the bed, etc., Condon found of little value. He had thought of making the peritoneal cavity an absolute instead of a potential one by injecting air, thereby making it easier to change the position of the intestines by elevating pelvis, but concluded this would not be nearly as efficacious as injecting some fluid intra-abdominally, and then placing in a sitting position. This fluid would then gravitate into the pelvis and displace the intestines upward, and thereby relieve the pull.

Since January, 1915, they have had in the Nicholas Senn Hospital 8 well-marked cases of postoperative gastromesenteric ileus. In each lavage was resorted to every few hours, and after several washings with no abatement of symptoms the injection of Ringer's solution into the peritoneal cavity was made. Several of these patients were deeply intoxicated, and in each instance all symptoms were promptly relieved. The technic is simple, the instruments necessary such as are used in hypodermoclysis. They make the point of injection in midline below umbilicus, but any part of abdomen may be used. A small amount of local anesthesia is used at site. A medium-size lumbar puncture needle is slowly passed through wall with rotary motion, having the fluid in needle under some pressure, so the intestines will be pushed away as needle enters. From 2000 to 3500 c.c. can be tolerated. After the necessary amount of fluid is introduced, before removing needle a few hundred c.c. of air are injected, making the peritoneum an actual instead of potential cavity, facilitating change of position of intestines. After injection patient is placed as near sitting as possible, and lavage continued about every 3 hours, till the stomach secretions become normal.

An example of *obstruction due to a Meckel's divertic-*

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(8) Annals of Surg., July, 1919.

ulum was successfully operated on by R. Margarey.[9] A man, of 20, while playing football was suddenly seized with severe pain. Operation in an hour or so, a loop of bowel was found constricted through an aperture formed by a cord passing from the tip of diverticulum to the mesentery. After excising the pouch the stump was closed by pursestring. The bowel resumed its natural color as soon as the constriction was divided.

[We hardly agree with the author that the pouch (size and length of thumb), was of unusual size, nor that the complete circle formed by the aperture was rather unique. It is, however, exceptional for cord-like filaments to be given off the larger diverticula.—Ed.]

Two cases of *obstruction from the Murphy button* were met with by A. Wettstein.[1] During 1908-11, while at Stierlin's clinic, in the Cantonal Hospital at Winterthur, the button was used considerably and with no bad-effects. In his own practice, however, he has had these cases, both with recovery after operation:

I. Woman, of 49, gastroenterostomy done Sept. 23, and symptoms of ileus developed and necessitated operation Nov. 14. The button was discovered about 8 in. above the valve, and extracted through ileum. Inspection proved the button had probably been lodged considerably higher up, and become loose during the narcosis.

II. Woman, aged 36. Oct. 23, 1912, gastroenterostomy, for ulcer as in Case I. Here the symptoms kept up till May 31, 1917, when obstruction became manifest. (In both instances x-ray showed the stoma was functionating properly.) At operation the button was lodged some 12 in. above valve, completely stopping lumen.

Several other examples of overdue retention of the button are recorded, the interval ranging from about 15 weeks to as many years. The last, that of Kelling, was one in which the button was retained in the stomach for 15½ years. As a result of his experience Wettstein resorts to sutures instead of the button, believing the latter is to be used only where the condition is such great rapidity of technic is necessary.

[This feature was considered in a paper by Weir,

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(9) Med. Jour. Australia, Dec. 21, 1918.
(1) Corr.-Bl. f. Schw. Aerzte, March 20, 1919.

years ago (1905 volume, p. 334). See especially Murphy's discussion.—ED.]

Three cases of *obstruction from Ascarides* have been reported: The first 2, by A. Kotzareff[3] were unusual in that they occurred in adults, women of 40 and 60. Neither had ever exhibited any sign of obstruction, nor was the presence of the round-worms suspected. Acute symptoms at length necessitated intervention, and partial stenosis found due to membranous adhesions, the worms lodging in the partly occluded section caused complete obstruction.

The other, case seen by G. Aperlo[4] as usual was in a child, of 7. Here complete stoppage was set up by a mass of 60 worms. He believes in addition to the mechanical effect, the irritation caused by these worms may set up spastic ileus.

[Several cases of this obstruction have been quoted in the Surgery volume of recent years, and it is probably by no means so rare as used to be supposed.—ED.]

Thirteen feet of ileum were resected by J. R. Littlefield.[6] A patient, aged 22, had been operated on for pus-tubes in September, 1917. She remained in good health until March 15, 1919, when she complained of pain with vomiting and preceded by constipation. Her condition increased and, March 22, the vomitus assumed a fecal character. Small semisolid bowel evacuations. 17 and 18. On the night of 22, was brought 159 miles to hospital.

On opening peritoneum a moderate amount of blood-stained fluid escaping with the protrusion of a large segment of gangrenous and distended bowel. Large areas of peritoneum had sloughed from the bowel wall, and muscular coat was plainly visible. The omentum was rolled into a firm band and, with a knuckle of intestine, adherent to l. horn of uterus. These adhesions were broken and the entire gangrenous bowel and measuring 13 feet, was excised, the mesentery being rapidly ligated as the resection progressed. End-to-side anastomosis by sutures, end-to-end being impossible, there

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(3) Rev. Med. Suisse Rom., April, 1919.
(4) Il Policlinico, Sept. 14, 1919.
(6) Jour. Amer. Med. Ass'n., Sept. 13, 1919.

remaining only 6 in. of jejunum and what appeared to be about 48 of ileum. Abdomen closed without drainage; time, 70 min. Two months after discharge she had gained 16 lbs. in weight, and ate well, but had pains after eating coarse food, etc.

[Several other instances of extensive resections are noted in previous volumes, *e. g.*, 1912—10 ft. 8 in.; 1914—over 11 ft.; 1915—10 ft. The longest seems to be Brenner's case (1910) nearly 18 ft.—Ed.]

Enterostomy for postoperative ileus paralyticus is recommended by J. C. Culley.[7] Every surgeon can recall cases which, following laparotomy, exhibited symptoms of obstruction—abdominal pain, nausea, vomiting and marked distension, which, under appropriate medical treatment, disappeared in 24 to 48 hours. But cases resulting from a local or general peritonitis, refuse to yield to treatment. Every means should be used to prevent its occurrence, and all medical measures should be resorted to, *e. g.*, pituitrin, eserin and duodenal lavage.

But when there is distension which looks incapable of recovery unless given mechanical relief the bowel should be emptied. Oftentimes we encounter a condition which will not warrant handling of the bowel any more than absolutely necessary. All that should be done is to protect the peritoneum as much as possible, open into the distended loop or loops, provide adequate drainage and thereby eliminate the toxic substances.

[The most effective means for preventing postoperative ileus consists in making gastric lavage the moment intestinal distension first appears with water at 105 to 110° F., and to repeat this in case the distension returns. To give absolutely nothing by mouth, and to give nourishing enemata and water by rectum by the drop method every four hours.—Ed.]

Intussusception. A *series of 50 children* was operated on for intussusception by P. L. Hipsley.[8] The ages varied from 4 to 35 months, and only 8 were girls. In 46 the type was noted and was ileocecal in 21, cecal in 19, and ileal in 6; 2 of these last became double.

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(7) Southern Med. Jour., October, 1919.
(8) Med. Jour. Australia, Nov. 9, 1918.

The incision used in nearly all was 2.5 to 3 in. long with umbilicus at its centre and just to r. of midline. The sheath of rectus was opened and muscle retracted to one side. The incision in peritoneum was just long enough to admit 2 fingers, because even a long intussusception can be partially reduced inside abdomen by manipulation between the hand outside and fingers inside. The wound in most cases was sutured in layers, care being taken to insert at least 4 silkworm-gut sutures to reinforce the catgut. These are tied over a thick strip of gauze, and after covering this with a narrow pad, wide strips of adhesive are fixed over all, so as to cover completely the whole of the gauze below and up to the top of the pad. The strapping prevents any soiling of the wound, and the dressing is left undisturbed for 11 or 12 days, when all sutures are removed. A number of deaths have been reported, either from peritonitis, attributable to infection spreading along silkworm-gut sutures, which have been passed through all the layers of the wall, or to the wound having given way in a week or more, resulting in the bowel being prolapsed into the bed. Such accidents are not likely to happen if the incision is not too long and if the abdomen is sutured in layers. There is another danger in using silkworm-gut sutures through all the layers of the wall—they sometimes lead to adhesions and cause obstruction, even years after operation.

In the series, there was no death where operated upon within 36 hours of onset. Four died; in one case the symptoms had been present for just over 36 hours, in two others the children had been ill for 3 days, and the fourth child had been ill for 4 days. Indeed, two infants were *in extremis,* and it was questionable whether they should have been operated upon at all. However, seeing that there is a chance of cure, all were operated on.

In the case narrated by J. M. Van Cott[9] the patient was an adult, aged 45. Gastroenterostomy 5 years previous for gastric ulcer, never well since. Three days before after drinking some beer, suddenly started to vomit, this kept up, vomitus blackish, no particularly bad odor. Diarrhea also, but this ceased by bismuth, while vomit-

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(9) Long Island Med. Jour., September, 1919.

ing continued. Operation refused, death in few hours. Necropsy revealed 14 in. of upper jejunum telescoped into stomach, and gangrenous.

Another adult, of 38, was operated on successfully by G. Nyström.[1] Here the transverse colon was involved. The pains were not of the colic type and were located in the lower bowel so they suggested bladder disease, especially as there was complete retention of urine the 2d day and the man vomited, but the vomit was not fecaloid. There was a tendency to diarrhea and the second night the stools showed fresh blood. At laparotomy (4th day), the invagination was reduced and omentum brought down over the excessively long transverse colon, to prevent further invagination, held with fine catgut.

What is believed to be the *youngest patient successfully treated by resection* is related by E. R. Flint.[2] A boy-baby, a day less than 3 months was admitted 2 days after onset. Saline and warmth for 2 hours before operation. This is excessively easy. The peritoneal cohesion, on the outer side of colon, has scarcely occurred at this early age, and the amount of fixity which there is has been loosened by the drag of the intussusception. The time required is not long, and most of work can be done outside abdomen with ease. This is the quickest and best method for irreducible intussusceptions, and its applicability up to the present has been limited to these cases. The mortality is undoubtedly high, but so is that of other methods.

Not enough attention has been paid to the preoperative treatment. The high mortality, even among those cases in which reduction is easily accomplished, is due to shock, largely accounted for by the loss of fluid, partly from vomiting, and partly from filling of the intestine with excess of fluid. An hour or two devoted to giving subcutaneous saline in relatively large quantities, gives better prospects than immediate operation. During this period the pain should be prevented by some form of opium, and heat should be applied as well as at operation. Quick operating is essential, but above all peri-

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(1) Upsala Läk. Förh. (quoted in Jour. Amer. Med. Ass'n., June 28, 1919).

(2) Lancet, May 31, 1919.

tonitis must be prevented. There is some chance of recovery from shock, but none from peritonitis.

During the 3 years Flint operated on 33 cases with 14 deaths (42.4%), the average mortality of published statistics including all types is just over 50.

Reduction: 6 cases, 2 deaths.

Reduction and appendectomy: 14 cases, 1 death.

Resection: 13 cases, 11 deaths. Mortality 83.9 per cent.

These resection cases were all impossible to reduce.

Two instances of *compound intussusceptions* were met with:

I. In 900 consecutive laparotomies by K. A. Lees,[3] 20 were for intussusception, one in a man, of 45, the rest in children. Of these, 13 recovered. Of the 7 fatal cases, the adult had incipient gangrene of the cecum; as his condition appeared too serious to justify a resection, a simple cecostomy was done after reduction, but an acute infection spread to the abdominal wall. Of the children, 3 died of shock and 2 of bronchopneumonia; the last was a recurrent case with many adhesions necessitating a more prolonged operation.

Fig. 135. Ileocecal and retrograde intussusceptions advancing toward each other (Lees).

In one of the fatal cases, an ordinary ileocecal intussusception had progressed to the transverse colon; here it had been met and covered by a retrograde intussusception starting from the splenic flexure. The result was that there was an immovable mass in the umbilical region, looking at first like a pancreatic tumor, because it appeared to be attached to the post. abdominal wall. Lees soon discovered, however, he was dealing with the colon all rolled up in a ball, so to speak. When, however, he realized the possibility of a retrograde intus-

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(3) Practitioner, October, 1919.

susception, it was found that reduction could be effected by milking towards the splenic flexure, and while this was being reduced there appeared from beneath the common type of intussusception whch required milking towards the cecum. The more prolonged handling and anesthetic, however, caused the child to die of shock.

II. A boy, of 2, operated on by J. P. Buckley,[4] had been ailing for 5 or 6 weeks. Abdominal palpation revealed what appeared to be an isolated, firm mass in l. upper quadrant, and a soft. less well defined mass in lower abdomen. This soft mass could be more definitely detected by one finger in rectum and the other hand on abdominal wall. The rectum itself, as far as the forefinger could reach, was empty. Diagnosis uncertain, probably intussusception. Immediate operation, the total length of the intussusception *en masse* before reduction was between 10 and 12 in. long. The proximal 3 in. was firm and distally limited by a cuff-like edge from the remainder of the intussusception. It was this portion which could be so distinctly felt in upper quadrant. The distal 7 to 9 in. represented the soft swelling felt in the lower abdomen. It was at once evident there was a retrograde intussusception superimposed upon the proximal 3 in. of a direct intussusception. The retrograde cuff gripped the direct intussusception so tightly it was apparent that before the latter could be "milked" back the former would have to be reduced. This was no easy matter. The "milking" was useless for the retrograde portion, and reduction was effected by squeezing the forefinger between the free edge of the

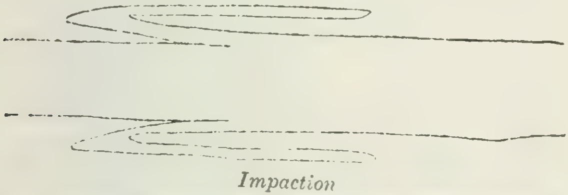

Fig. 136. Ileocecal embraced by retrograde intussusception (Lees).

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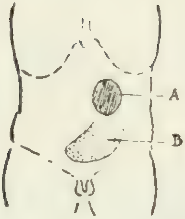
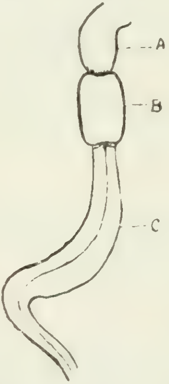
(4) British Med. Jour., Nov. 22, 1919.

cuff and the ensheathing layer of the direct intussusception, and exerting a gentle and carefully graduated "shoehorn" lever maneuvre. By this means the retrograde cuff was successfully reduced, and as soon as this had been effected the direct intussusception was "milked" back with ease. Speedy recovery.

Buckley believes the mechanism is as follows: A preliminary condition exists of a descending or direct intussusception of the ordinary type, together with an ascending or retrograde intussusception further along the bowel. The apex of direct eventually reaches the proximal end of the retrograde intussusception, and the former commences to be swallowed by the latter. This can go on until the retrograde forms a tight cuff surrounding the proximal end of the other.





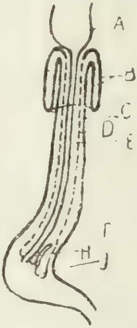


Fig. 137. *A*, hard, rounded tumor; *B*, soft, indefinite tumor.

Fig. 138. *A*, small intestine; *B*, tight cuff of retrograde intussusception; *C*, direct intussusception.

Fig. 139. *A*, dilated small intestine; *B*, retrograde intussusception; *C*, intussuscipiens of direct intussusception; *D*, returning layer of direct intussusception; *E*, entering layer of direct intussusception; *F*, appendix; *H*, valve; *J*, caput cecum (Buckley).

Of 2 cases of *intussusception due to polypi*, No. 1, seen by E. C. Bevers[6] in a boy, of 5, had a history of suffering all his life from acute paroxysmal attacks, preceded by vomiting, and followed by tenesmus with passage of blood and slime. They varied in severity,

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(6) British Med. Jour., Oct. 25, 1919.

lasted 24 to 36 hours, and occurred about every six weeks. The pain during several of the attacks was most marked in r. iliac fossa. They were thought at one time to be due to chronic constipation, but persisted even when the bowels had been carefully attended to. On two previous occasions the child had been admitted, but the attack passed off, and there seemed to be no direct evidence of intussusception. Immediate operation successfully performed.

The intussusception was of the enterocolic type, the small intestine with the polypus (adenoma) at its apex passed through the valve for some distance, the cecum, appendix, and colon being subsequently drawn in. It is probable that in the previous attacks the intussusception was confined to the small intestine, the polypus approaching to or reaching the valve, but not passing through until the final attack.

Another case, operated on by R. J. E. Oden[7] was in a negro male, aged 22, in the A. E. F. For a year prior to enlistment had frequent attacks of diffuse abdominal pain. These recurred after 4 months' service abroad, and he was sent home with various diagnoses —gastric or duodenal ulcer, tuberculous peritonitis.

After 4 months' stay in medical wards he was transferred to the surgical. Finally at operation, the stomach, duodenum, and colon were found normal, but a portion of small bowel was distended. Upon further examination, an intussusception of jejunum, containing two tumors, one above and one below the invagination, 12 in. from the fossa of Jonnesco, was delivered. The circulation was not impaired and though the bowel was highly injected and swollen there was no evidence of strangulation, but as there was an absence of adhesions, the involved gut was reduced with but little difficulty. There were no enlarged glands, but the mesentery was more than three times that of normal and contained dense fibrous tissue, showing evidence of former severe inflammatory changes. A further examination revealed two pedicled intraluminar tumors about 4 in. apart. Shortly after reduction, there was a marked retrogressive peristalsis, with a drawing up of the large tumor

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(7) Surg., Gynecol. and Obstet., November, 1919.

into the proximal section, showing a tendency toward recurrence. Because of this and the condition of mesentery, a 10-inch section with its mesentery, was removed, an end-to-end anastomosis was made. The patient passed gas after the first 36 hours, and made an uneventful recovery. The pedunculated tumors were fibroadenomata.

Stasis. The *indications for operation in chronic intestinal stasis* are formulated by Sir W. A. Lane.[9] In the vast proportion no question of operation arises. The administration of paraffin before meals, use of a belt, the recumbent posture at intervals, careful dieting, and such drugs as relieve hyperacidity, etc., will usually afford complete relief.

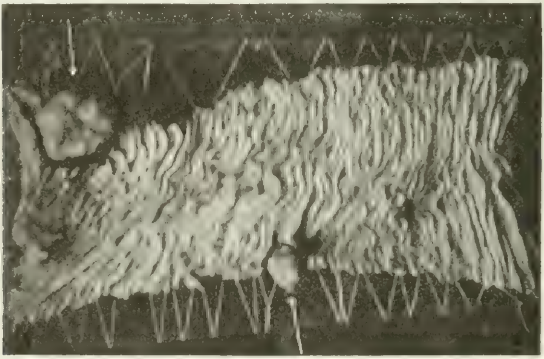

Fig. 140. Section of jejunum with two intraluminar pedicled fibroadenomata (Oden).

The next question is, What are the conditions requiring gastroenterostomy? When a peptic ulcer is present in the stomach or duodenum, or in both, gastroenterostomy should be performed, and in the case of gastric ulcer it should be excised, or otherwise dealt with to ensure its cure. When the stomach and duodenum are dilated and the latter obstructed by kinking at the duodeno-jejunal junction that no freeing of the stasis in the lower bowel is likely to overcome this angu-

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(9) Lancet, March 1, 1919.

lation, and as these constitute antecedent changes in a sequence which ends in ulceration and, finally, in cancer, a gastroenterostomy should be performed.

Finally, What are the conditions which call for colectomy? In extreme constipation in which an evacuation can be obtained only at intervals and with great difficulty and pain; rapid and progressive wasting; mental depression which may be so great at times as to make life intolerable; total inability to lead an active life; progressive degenerative changes in the breasts of those with marked family history of cancer, toxic changes in the heart and circulation, and all secondary conditions such as rheumatoid arthritis, Raynaud's disease, Still's, many forms of tubercle, Bright's d., Addison's d.: in these and many other conditions colectomy offers the only hope of cure.

Diverticula. In a woman, of 36, acute *diverticulitis of the transverse colon simulated carcinoma.* There was a history of attacks of pain for 18 months, and an acute attack some 6 hours previous. Vomiting and the signs of acute appendicitis were all present with the exception the maximum tenderness and rigidity were situated to r. of and close to the umbilicus. This was noted, but H. F. Vellacott[1] made the diagnosis of appendicitis without hesitation.

At operation the appendix was found easily, and obviously not the cause. In the transverse colon a mass the size of a large walnut was felt in upper and posterior wall. The omentum was wrapped round this. From the mass a thick band passed up in mesocolon towards the central lymph nodes. This band and the mass were so hard that malignant disease with perforation, was diagnosed, about 6 in. of the gut resected, and end-to-end union made. Great care was necessary in the resection, as the thickening in the mesentery involved the sup. mesenteric vessels. The resected segment was slit down, and the true diagnosis became apparent. No other diverticula were seen on the exposed part of the bowel. Uneventful recovery.

Examination of the mass after removal showed a diverticulum about .25 in. wide—as usual containing

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(1) British Med. Jour., Aug. 2, 1919.

a fecal concretion—which had perforated into the peritoneum in front of the mesocolon.

[The author believes the location, and age of patient are of interest. Such pouches are less common in the transverse than in the pelvic-colon, it is true. But as to age, I am informed by J. R. Pennington* that of 133 cases he collected, 19 were under 40. The sex is of more interest, he adds, in 154 cases only 41 were in females.—Ed.]

Tumors. At a meeting of the Paris Surgical Society, M. Auvray[2] stated he had removed a *fibrous tumor attached to the small intestine* of a soldier. He had suffered for some time with intense crises of abdominal pain, vomiting and diarrhea. On palpation a mobile growth was detected in paraumbilical region. At operation it was found encased in fat, and hanging from free border of bowel, hence removed without resection. The structure was fibrous impregnated with lime salts, and in places bony plaques.

In the discussion, M. Chevrier stated he had removed a tumor from the small bowel near the cecum. The patient had had appendectomy some time previous, yet the painful attacks continued. After removal the mass was found to have developed about a silk ligature.

A woman, of 44, with a *myoma of the small intestine*, was operated on by F. S. Mathews.[3] She came several weeks before, stating a hypogastric tumor had been noted quite recently. On examination, tumor was found irregular, hypogastric and more to l. side. On bimanual examination the cyst ruptured. In a few min. pulse became slow and weak, pain was severe and there was cold, clammy skin. Taken to hospital immediately and after a short application of external heat, to operating room. The abdomen contained considerable bloody fluid. The tumor was cystic and solid and there were abundant evidences of previous hemorrhages into the mass. It was dissected without resection, a small tear being made in mucosa. Its origin was from lower ileum, and possibly originated in a Meckel's diverticulum, as it lay entirely opposite mesentery and was supplied by 2 arteries from mesentery which crossed the wall of gut. The tumor proved to be a smooth-cell myoma. Before rupture of the cyst, would have measured 7 or 8 in. in diameter. Recovery uneventful.

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*Personal communication to Editor.

(2) Progrès Méd., Nov. 22, 1919.

(3) Annals of Surg., June, 1919.

Mathews emphasized the infrequency of such myomata except in the uterus; the rupture from very gentle manipulation, with immediate severe symptoms, was also deserving of note.

D. Symmers[4] discusses the *association of malignant myomata with Meckel's diverticulum.* Subserous, occasionally submucous leiomyomata are encountered in the stomach, intestine or gallbladder in less than 1% of necropsies. As a rule, they are solitary, rarely multiple. Seldom do they exceed .4 in. wide. Judging from the small number in the literature of malignant myomata of the stomach, intestine and gallbladder, and comparing this with the number of subserous or submucous leiomyomata met with in corresponding situations in routine necropsies, the assumption seems reasonable that these apparently insignificant growths undergo transformation into malignant myomata with a degree of frequency which entitles them to attention as a potential source of danger. If accidentally encountered at operation, they should be removed.

The majority of malignant myomata of the stomach, intestine and gallbladder thus far reported were found in organs which otherwise appeared to be intact. In rare instances, however, these growths bear a definite anatomic relationship to Meckel's d. The malignant myomata of the stomach, gallbladder and intestine, including those associated with Meckel's d., are capable not only of extensive local expansion, but of widespread metastasis. Their degree of malignancy is apparently in excess of that of their prototype, the malignant myomata from tumors of the uterus.

Sarcoma. Two examples of *primary lymphosarcoma* were operated on by W. H. Fisher:[5]

I. Male, aged 61, addicted to daily eating of white sand, with history of rapid emaciation and beginning

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(4) Ibid., August, 1919.
(5) Ibid., May, 1919.

cachexia, presented a firm mass in l. umbilical region. Operation revealed tumor of ileum, size of egg, encroaching upon the mesentery with much thickening of mesenteric fold and induration of a large section of ileum. Three feet with corresponding mesentery resected, followed by enterocolostomy. Death 10 months later from acute hemorrhage of bowel with severe pain and tenesmus.

II. Woman, of 67, nearly 2 months previous had pain in r. abdomen, and soon noticed a "lump." Palpation demonstrated a tumor, freely movable, not sensitive in upper r. quadrant. The balance of organs were normal. Examination of stools demonstrated occult blood and bloody mucus. Operation revealed a nonadherent tumor of colon about 2 in. below hepatic flexure size of small orange. A contracted gallbladder filled with stones also present. Owing to the severity of symptoms a two-step operation was deemed advisable. The asc. colon was excluded and ileum anastomosed to l. transverse colon. There was an interim of 3 months before second operation, of decided improvement and a later recurrence of pain and ill feeling that forced further intervention. On opening abdomen, the tumor had penetrated the wall of colon and through the transversalis and oblique muscles, the colon firmly adherent to wall and under surface of liver. The affected portions were removed *en masse*, as well as perirenal fat, superficial lymphatics of kidney, gallbladder and mesenteric glands. Bleeding somewhat profuse. The omentum utilized in the exclusion of the large abdominal space. Both the gallbladder and kidney area were drained, tubes removed on the seventh and fourteenth day, respectively. Left hospital fourth week, wounds closed. Up to time of report no further signs.

Stenosis of the bowel was not present in first case. In II x-ray findings and first operation showed a patent lumen, but with the lapse of time occlusion developed to practically complete obstruction.

Carcinoma *of the small intestine* is discussed by E. S. Judd.[6] The records at the Mayo Clinic show that carcinoma has occurred 24 times in the small as com-

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(6) Journal-Lancet, April 1, 1919.

pared with 1,822 in large bowel and rectum and 1,689 times in stomach. For some unknown reason, an almost complete minority of carcinoma in this region.

In this series carcinoma occurred 5 times in the duodenum, 11 times in jejunum and 6 times in ileum; and in 2 the lesions occurred in different parts of small bowel. In a few the neoplasm was close to the juncture of duodenum and jejunum and it may have been primary in 3d portion of duodenum or in 1st part of jejunum. Carcinoma here varied from the typical carcinoma elsewhere in the gastrointestinal tract in that several developed on polypi or papillomas. In a few instances only did they observe the true colloid carcinoma, similar to the ordinary intestinal carcinoma.

The average age of patients with duodenal carcinoma was 53; with jejunal, 46; and in ileum, 50.

Duodenum.—In Case 1 of this group the eructation of food for some months suggested ulcer primarily, although there was no other evidence. A mass was palpable, and thought to be in pylorus until the exploratory incision. The history furnished no indication that an ulcer was present prior to the carcinomatous growth. In Case 2 the history is not of much importance, since the patient also had a carcinoma of the stomach. However, a history was given of 20 years of stomach trouble, which suggests the existence of a high gastric ulcer prior to the carcinoma. In Case 3 the lesion occurred near ampulla and was so extensive no estimate could be made of its exact origin. Case 4 was reported as carcinoma of duodenum. There is nothing in the history to suggest that it had formed on an ulcer. Case 5 was first diagnosed as duodenal ulcer. The man was 58 years, and gave a history of having had trouble for 8 months. At operation it was impossible to discover where the tumor originated, though it obstructed the duodenum. It in no manner resembled a duodenal ulcer.

Jejunum.—8 cases occurred in men and 3 in women. In most instances, the patients had had symptoms only a few months, in some only a few weeks. In one case, however, some intestinal symptoms had been present 20 years, and in two symptoms had been present for 2 and 3 years, respectively. The histories do not show great similarity, and it was almost impossible to diagnose the nature or location of the obstruction. present in every instance. Occasionally the tumors could be felt, although this was not helpful. Pain was severe and colicky, and had occurred intermittently for some weeks. There was no definite localization, although it was most frequently in one of the iliac fossæ. Weight loss was very rapid, and in most cases was marked at the examination.

Ileum.—In 4 cases the symptoms were of short duration, from 1 to 21 months. In one there had been indefinite intestinal symptoms for 10 years, and in this particular instance the lesion formed on a degenerating polyp. The tumor might have been producing the symptoms all of these years. In one there was a history of diarrhea for 2 years. The principal lesion was a carcinoma of cecum, and the tumor in ileum was not responsible for the symptoms. It was impossible to determine the location from the histories.

THE VERMIFORM APPENDIX.

Position of Appendix. This was noted by A. S. M. Tymms[7] in *56 operations:* In 34 in r. iliac fossa, either enclosed in the omentum, adherent to the cecum, lying against mesentery, or free; in 14 lying over brim of pelvis, free in pelvis, or adherent to ovary, tube or bladder. In 8 it was retrocecal, in one of these it was altogether retroperitoneal as well.

An extreme displacement was encountered by Straub and Milnor,[8] in a man, aged 38, who had had symptoms for 5 years. The cecum drawn up about 3 in. out of position, while the transverse colon formed a rather long loop hanging down below the umbilicus, without omentum. It was this loop constantly appearing in the wound that led astray for 30 min. in exactly locating the appendix. The base of the appendix was finally found 3½ in. above McBurney's point, not postcecal, but anterior and adherent to some organ above, pulling the cecum up and dragging the ileocecal junc-

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(7) Med. Jour. Australia, Nov. 23, 1918.
(8) Jour. Amer. Med. Ass'n., Jan. 11, 1919.

tion with it. The illustration shows how the appendix in its course crossed part of the asc. colon, constricting it and also the beginning of the transverse colon, and then crossing the duodenum under the gallbladder passed underneath the pylorus ending on and adherent to the head of the pancreas. As it was impossible to do anything more than locate the base through the first opening, a high rectus incision was made through which the tip was secured and freed, a most difficult task, as the adhesions were very firm and numerous. Once loosened, the tip was brought out of the McBurney incision. The cecum then was able to occupy its normal position. The appendix was 6 in. long, of normal thickness, and aside from two strictures and a moderate chronic congestion, did not present any abnormalities. No mesenteriolum. Uneventful recovery.

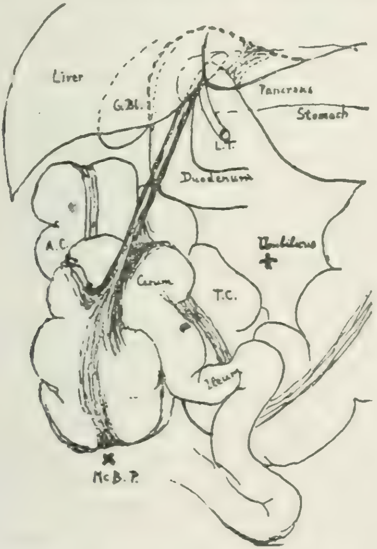

Fig. 141. Position of appendix, tip adherent to pancreas, thus pulling the cecum up (Straub-Milnor).

Discussing *McBurney's point*, A. H. Bogart[9] states

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(9) Long Island Med. Jour., July, 1919.

in his own experience he has removed the appendix from almost every location in the abdomen, including the l. iliac fossa in transposed viscera. In all these cases the pain, tenderness, and rigidity were over the site of the appendix in uncomplicated cases, after the first few hours following the onset. Not infrequently particularly in women one finds the appendix entirely within the pelvis and giving symptoms which might be attributed to acute disease of the pelvic organs. In such cases the tenderness, etc., are much lower down, and the diagnosis is not complete without a rectal or vaginal examination. The importance of a correct diagnosis in such cases is evident, when it is remembered that in the appendix case operation is indicated at once, while in the other it should not be done except to evacuate collections of pus. Again in undescended cecum one may find the appendix high up simulating gallbladder disease, and without the usual findings at McBurney's point, and a retrocecal appendix may have its maximum tenderness in the loin.

It is as true as it was when it was written, that pain, tenderness and rigidity at McBurney's point associated with the other usual symptoms usually means appendicitis; it is also true, however, that the absence of pain, tenderness, and rigidity at this point does not exclude appendicitis, for the reason that the appendix may be (and frequently is) located somewhere else.

[In his article in Keen's "Surgery," (Vols. IV. and VI.), J. B. Murphy gives a full account of these malpositions, with pictures of several types.—Ed.]

E. M. Magruder[2] furnishes some details about *hereditary predisposition to appendicitis.* In four families totaling 60 persons, 19 were afflicted.

[See also Pennington's article (Malignant Growths) for heredity in carcinoma.—Ed.]

Ruptured Appendix at 10 Months. The girl-baby, operated on by D. Hadden[3] had been under the feeding directions of a pediatrician for some months. The diet was largely modified milk, with cereals and strained spinach. After evening meal eaten as usual, was fret-

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(2) Virginia Med. Monthly, March, 1919.
(3) Amer. Jour. Obstetrics, January, 1919.

ful but toward morning became collapsed, pulse and respiration rapid. Abdomen generally tender and dull over bladder and r. groin. Examination under ether showed 2 findings supposed to signify ileocecal intussusception, vacant iliac region, and tumor mass in r. hypochondrium. Operation, however, through the middle third of rectus showed a large amount of flocculent fluid free in abdomen, a high cecum with almost adult-sized appendix gangrenous over 2 large hard dark concretions. There was only an elementary omentum, and no evidence of protective adhesions anywhere. The convalescence was uneventful; with drainage closed within a week. The main interest was the simulation of an intussusception, which led to immediate operation and, probably thus saved life.

Diagnosis of Appendicitis. G. Brun[4] emphasizes the importance of the *painful point in lower right lumbar region* in acute appendicitis. In a large number of patients recently, he noticed the intensity of pain and the contracture was less marked than usual in the iliac fossa, *the maximum intensity was further back, in the lower lumbar region.* Operation showed the appendix in each was retrocecal. No doubt this sign has been observed by many others, but it is not referred to in the texts, or at most only casually. While anatomists put the frequency of this position at 13 to 16%, surgeons find it in 30 to 40% of operations. This location, while not confined to children, is more frequent in them. Brun believes this point should be carefully searched for in cases where with the customary symptoms, the signs in the iliac fossa are ill-defined.

It can be elicited above the iliac crest in the midportion of Petit's triangle, with maximum intensity at the outer angle. The pain is sometimes accompanied by contraction of the muscles of post. wall of abdomen. Control by palpation of the opposite side, enables one to appreciate the sign better. He has met with this sign in 30% of his cases, and the diagnosis confirmed by operation. In addition to the diagnostic value, it enables the surgeon to be aware of the abnormal position, and map out his incision accordingly.

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(4) Presse Méd., Jan. 16, 1919.

X-Ray Examination. After experience in *300 cases*, E. I. Spriggs[5] believes it is possible to observe the appendix with the *x*-rays in the large majority, by use of an opaque meal after preparation with castor oil.

The normal appendix fills and empties about the same time as the cecum. It may, especially in young people, fill and empty repeatedly, while the cecum remains full. The best view is usually about 12 to 14 hours after the opaque meal. Direct *x*-ray examination is of much help in the diagnosis of chronic appendicitis. With adequate observation it is found the proportion of cases in which no barium enters the appendix is small. In determining whether the appendix is or has been diseased attention must be paid to filling and emptying, shape, mobility, position, and the presence of concretions, hyperactivity, spasm, or tenderness. Continued contractions and spasm are associated with active inflammation. The existence of a tender point is a valuable sign, but requires care in its interpretation. Details are given of 36 cases, in all of these the diagnosis was verified at the operation.

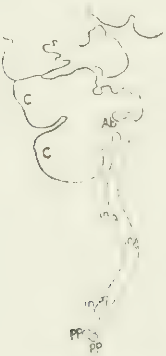

Fig. 142 Tracing of radiogram of appendix.

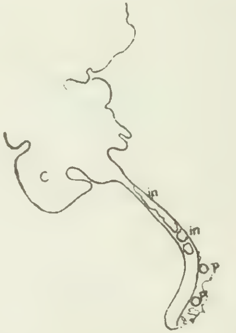

Fig. 143. Same.

Ab, appendix base; *c*, cecum; *in*, inopaque material; *pp*, pellets of shot (Spriggs).

W. B. Ainger[6] alludes to a case in which *shot in the*

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(5) Lancet, Jan. 18, 1919.
(6) British Med. Jour., May 10, 1919.

appendix were revealed by *x*-ray: A man, of 34, for 6 or 8 months had "bilious attacks." These had come on at intervals of about a fortnight and lasted 1 to 2 days. They were associated with shivering, malaise, and occasional vomiting. As the attacks continued a bismuth meal was decided upon, and the radiograms revealed what appeared to be two No. 6 shot, in the region of the appendix, which could be freely moved under the screen. The patient was thoroughly purged and a second skiagram showed the shot in same position. Appendix removed and two No. 6 shot found at the tip which showed signs of having been recently inflamed.

Complications. S. T. Irwin[7] has come across 87 cases of *acute appendicular obstruction*, of which 10 showed obstruction only, 18 obstruction with a varying amount of gangrene of the wall, and in 59 rupture had followed the gangrene. In these obstructive cases it is his contention the primary cause is obstruction of the lumen. On examination of the appendices removed at operation it is found that obstruction may be due to:—(1) Concretions; (2) strictures; (3) kinks; (4) bands; (5) foreign bodies.

Concretions are by far the commonest form, especially in those cases which go on to the production of gangrene: in his series they were present in about 50 out of 87 obstructed cases. *Strictures,* 6 cases. A typical instance of this variety was one in which soon after the administration of castor oil on the second day the patient, a boy of 16½ years, was suddenly seized with pain in iliac region. The cavity of appendix is divided by 2 strictures into compartments. The proximal compartment is continuous with the cavity of cecum. Its mucous lining and submucous tissue are alike normal. The middle compartment is completely gangrenous and perforated. The distal full of pus. *Microscopic appearances.*—Serial sections:—1. The strictures are both complete. Each is formed of a dense mass of granulation tissue which completely replaces the lumen, epithelial lining, and mucous coat. It is continuous with the submucous layer. 2. A section through the middle com-

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(7) Lancet, Jan. 18, 1919.

partment shows necrosis of all the layers, with a ragged perforation. 3. The terminal compartment tense, and filled with purulent material swarming with *B. coli.*

The third form of obstruction is that due to a *kink* by contraction of an adhesion between adjacent parts of appendix. Both ends of the adhesion take their attachment from the appendix. A similar angularity may be caused by a *band* one end of which is adherent either to peritoneum or other part of the alimentary canal and the other to a proximal part of appendix. Contraction causes the appendix to be drawn out to a sharp angle which interferes with the free passage of the contents. In obstruction due to bands and kinks the progress is generally slower than in concretions, and so, by giving time for protective adhesions, lessens somewhat the gravity of peritonitis, if and when it appears. *Foreign bodies,* such as worms, etc., are rare forms.

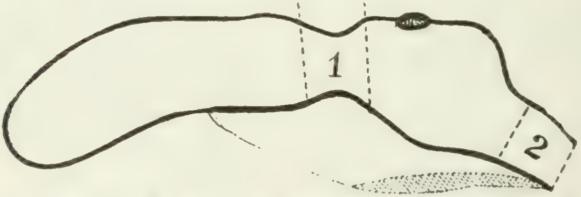

Fig. 144. Outline drawing of appendix showing position of two complete strictures at 1 and 2 (Irwin).

In a man, aged 27, under the care of R. A. Barlow[9] *acute appendicitis was followed by suppurative pylephlebitis.* In 1912, he had an attack suggesting catarrhal appendicitis, then remained well till July 21, 1913. Operation on 23d.

Apart from the rare recovery from suppurative pylephlebitis the following points are of interest:—1. A sudden collapse 4 hours after operation was very suggestive of an embolus having been thrown off from the vessels at the site of lesion. 2. The paucity of signs about the liver during the period of infection. 3. The comparative bradycardia which persisted in spite of the extreme variations in temperature and the presence of

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(9) Lancet, May 17, 1919.

obstinate constipation without distension, requiring daily enemata. 4. The treatment by intravenous eusol for this condition recorded for the first time and ending in recovery. This may not be entirely due to the eusol, but there is no doubt the infection was steadied, the spread combated, and the generalised toxemia so diluted and checked that recovery was made possible.

[See also Hernia Complicated by Appendicitis.—Ed.]

Influenzal Appendicitis. At an army camp. Hall and Dyas[1] estimate the average incidence of acute appendicitis per year at 10.4 per 1000. From Sept. 13. to Dec. 31, 1918, there were 92 operations. Of these 25 patients had had previous well defined attacks of appendicitis; 20 had had influenza during the epidemic, and 4 had pneumonia. One might well consider the latter under the influenza heading, as presumably every patient with pneumonia in this epidemic had influenza first; 5 had had a "bad cold" during the epidemic—presumably mild influenza. Thus 29 patients had had influenza, pneumonia or a notably bad cold since Sept. 13, 1918. This number would not at all account for the great increase in the cases of operative appendicitis, and they constitute almost a trivial percentage of the total number affected by the epidemic. The diagnosis of the pathologist was acute catarrhal appendicitis in 54 cases; acute suppurative in 15 and chronic catarrhal with subacute exacerbation in 23. There was but one death, a patient with previous cardiac murmur.

The data are insufficient to justify any exact conclusions as to the influence of the epidemic on the morbidity from appendicitis. Nevertheless, there is firm basis for the opinion some close relationship exists. It is extremely suggestive that on the first day of the influenza attack so many patients showed such definite signs in the region of the appendix as to lead to a diagnosis that proved to be incorrect, assuming their opinion on this point to have been well-founded. If this symptomatology was dependent, as they believe, on involvement of the lymphoid tissues of the appendix, one may readily conceive that in many other instances a definite inflammation resulted which eventually demanded operation.

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(1) Jour. Amer. Med. Ass'n., March 8, 1919.

M. Behrend[2] has seen in all 8 cases of *acute appendicitis complicating influenza.* Three were operated on and found to be pus cases. Not any of these gave a previous history of appendicitis. In one the appendix ruptured while in 2 pus was contained in the appendix. All recovered. Five were not operated upon because it was feared that the prevalence of râles would eventually result in pneumonia. The wide diffusion of moist râles reminded one more of an extensive edema than a characteristic pneumonia. On account of the "wet" lung an anesthetic was feared. Six were adults and 2 children. All were taken sick during the height of epidemic and had been in bed on an average of 4 days before the symptoms of appendicitis developed. In those not operated on the symptoms gradually subsided.

L. M. Warfield[3] asks is there a syndrome in *epidemic influenza which simulates very closely acute appendicitis?* The answer certainly is, "yes." It is not so easily differentiated as might appear from a table of symptoms, thus:

Influenza with Abdominal Onset.	*Acute Appendicitis.*
Onset sudden.	Onset sudden.
Pain not so severe.	Pain severe.
Occurrence during epidemic.	Occurrence at any time.
Pain, nausea (usually not vomiting), fever, may or may not be leukocytosis.	Triad of pain, vomiting, fever with leukocytosis.
Rigidity and spasm not so marked.	Rigidity and spasm.
Tenderness not so acute.	Tenderness acute.
Conjunctivitis.	No conjunctivitis.
Face flushed.	Face not flushed.
Faint cyanosis lips.	No cyanosis lips.

Technic. In *treatment of the appendix stump,* A. J. Brown[4] employs a method which seems safely to guard against the dangers of inversion and has given excellent results. Nothing original is claimed, it is more or less a combination of the various methods that have heretofore been suggested. Upon ligation of the mesentery

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(2) Surg., Gynecol. and Obstet., June, 1919.
(3) Wisconsin Med. Jour., September, 1919.
(4) Nebraska State Med. Jour., October, 1919.

which is usually done with ligatures, the proximal ligature is left long and held by an artery clamp. This controls the branches of the artery which supply the appendix, except the proximal portion at its junction with cecum. The mesentery after being divided is stripped back to junction with the cecum, laid open by separating the peritoneal layers and dissecting back by blunt dissection. This lays bare an area bounded laterally by the edges of divided peritoneum and passes from the base of appendix in front back to post. abdominal wall. In this area run the proximal branches of the artery which supply the base of the appendix and are brought into plain view when the mesentery is dissected back. A pursestring of Pagenstecher linen is then passed through the cecum .4 in. from base of appendix. The suture is begun directly opposite the attachment of mesentery and when the vessels are reached in passing the suture, the needle is passed through the cecal wall beneath the appendicular vessels. It is then continued on to the starting point. The base of appendix is crushed with 3 Kocher clamps laid side by side, and the remainder of gut protected by an intestinal pad beneath the proximal clamp. The middle clamp is removed, and the appendix ablated by cautery, and with a dull heat the stump is charred down to the surface of the remaining clamp. In this way the lumen is sealed by the cautery and the clamp, and hemorrhage is in part averted. The pad is removed, cecum steadied with a forceps just beyond cut mesentery, crushing clamp removed carefully so as not to disturb the apposition of the gut walls, and the edges grasped by an inverting forceps and the stump inverted. The pursestring is then tied and ends left long. Counter traction on the cecum between inverting forceps and forceps at mesentery thus makes complete inversion of the stump sure. If the clamp has been removed gently and the inversion performed carefully, the lumen has never been opened and there has been no danger of contamination by the contents of gut. Finally, the proximal branches of the appendicular artery have been inverted with the wall, and are now ligated securely by the pursestring. The final step is tying the ends of pursestring to that on mesentery. This covers over the inversion with serosa, thus affording a second layer of protection to the original suture of peritoneum, and obviates a second suture layer in gut wall.

It would seem, therefore, that a possible basis for standardization of technic might be: Ligation and cauterization of the stump in those cases where the condition of the cecal wall will not permit of suture, and inversion of the stump in all others.

K. A. Lees[5] observes for cases of retrocecal abscess in which the pelvis is not infected, *excellent drainage* is afforded by a tube in the loin, the incision of a size to fit the intended drainage tube being made, towards the end of the operation, about 2 in. behind the a. s. spine, not too near the crest of ilium for that position is more vascular. This provides a gravity drainage, when the patient is nursed a little on the r. side; the original incision may often be successfully sewn up, though sometimes there is a little late pus formation in the subcutaneous cellular tissue.

Drainage by rectum must be reserved for those cases of definite appendicitis in which the abscess is pointing into the rectum within 2 in. of anus. In any case which may be tuberculous in nature, this approach should be avoided. In 3 cases Lees opened into the rectum, the abscess drained effectively, and the patient left in a week. Three months later, a routine appendectomy was undertaken through an unscarred abdomen.

[See also Ritchie's article on pelvic drainage, 1919 volume, p. 473.—Ed.]

End-Results of Operation. Some of the *postoperative sequelæ of acute appendicitis* are enumerated by J. B. Deaver.[6] In 1700 recent operations there were 66 deaths (3.7%). The series included all cases with and without preoperative complications directly due to the condition of the appendix or of other viscera. The more frequent sequelæ requiring subsequent operations were fecal fistula, secondary abscess and obstruction.

Fecal Fistula.—In addition to 42 cases there were 6 operations, the original operations done elsewhere; one death falls in this group. There were also 28 additional

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(5) Practitioner, October, 1919.
(6) Pennsylvania Med. Jour., March, 1919.

fecal fistulæ, 22 of which closed spontaneously, 4 still open when patient left hospital and 2 with sinus still open at death. Altogether, there were 76 fistulæ and 10 deaths. Of the 48 operated on, 27 developed the fistula during convalescence from the appendix operation, the secondary intervention taking place as early as 3d and as late as 63d postoperative day. In the majority, however, the first signs appeared during 2d week.

Secondary Abscess.—Recorded 33 times with 7 deaths, making an incidence of plus 2 and a death rate of 21.2%. The secondary collection was:

Pelvic, 5 times (1 with fecal fistula); subhepatic and pelvic, 1; subphrenic, 10 (3 with fecal fistula, 4 deaths); subhepatic and pulmonary, 1 (also with fecal fistula, 1 death); peritoneal, 4; abdominal wall, 3; intestinal, 2 (2 deaths); inguinal, 1; rectal, 1; vesical, 1; pulmonary, 1; mesenteric, 1; parotid, 1 (several months after subphrenic abscesses following acute appendicitis). A favorite theory that more secondary abscesses develop in the pelvic region and are due to the Fowler position after operation is not borne out by the present series. The secondary collection was found in the subphrenic space more often than in the pelvic region, the incidence of subhepatic and subdiaphragmatic collections being about equal. The prognosis in the subphrenic space, however, is not so good as in the pelvic cavity; five of the fatal cases belonged to the former group. A study of the pelvic secondary collections indicates the fault to be due, not to the Fowler position but to late operation, incomplete operation, and insufficient drainage.

Intestinal Obstruction.—This occurred in about 1.5% and presents the high mortality of 40.8. (The original operation in 4 was done elsewhere.) Many patients were doing apparently well when the symptoms of obstruction suddenly developed. About 30% made a more or less uneventful recovery and developed the obstruction from a month to 4 years later. They usually gave a history of comparative freedom from symptoms until the sudden attack of ileus appeared, *i. e.*, until adhesions formed a band, or contraction of adhesions caused a kink or volvulus and produced the classic symptoms of progressingly severe pain, vomiting, visible peristalsis, distension and complete constipation.

G. P. La Roque[7] contributes the *end-results in 600 cases of appendicitis:* Of these 180 were pure appendicitis; 253 appendicitis with local peritonitis; 142 with regional peritonitis; and 25 with diffuse spreading peritonitis. There were 101 cases of abscess.

As to age and sex—42 cases were in children, and 12 in persons over 50. Only 40% were in males. Of approximately 250 women between puberty and the menopause, 6 were operated upon while pregnant. All clean cases, performed through muscle splitting incisions, and all went through normal pregnancy labor and puerperium without complication.

In the entire series there have been 2 of postoperative acidosis recognizable by stupor and unmistakable urinary findings. They were both in large abscess cases of many days' duration before operation in children. There have been 2 cases of femoral phlebitis, both of r. thigh, in men, and following operation in abscess cases. Three cases developed fecal fistula after operation. All were large abscess cases, 2 in patients with obvious tuberculosis of the bowel and advanced disease of the lungs, one in a boy with large abscess of 2 weeks' duration complicated by gangrene of cecum. The last healed in 3 weeks. The tuberculous bowel cases never healed, both patients dying of tuberculosis 6- and 18 months respectively after operation. One large abscess case was followed by annoying sinuses attributed to infection of a clot beneath the aponeurosis of ext. oblique.

Of the 600 patients operated upon, there were 4 deaths. A woman 7 days following operation for appendicitis and peritonitis of erysipeloid appearance; a man with gangrene and large hole rupture of the appendix and diffuse cathartic peritonitis 7 days following operation; and two boys almost moribund with diffuse cathartic peritonitis, one dying in 3- the other in 36 hours following operation.

[The term "diffuse cathartic peritonitis" is interesting, because in acute appendicitis nothing can be done which is more likely to cause a diffuse peritonitis than

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(7) New York Med. Jour., Dec. 28, 1918.

the administration of cathartics; and in our experience every case of diffuse peritonitis in patients suffering from appendicitis, has a history of having received cathartics after the beginning of the attack of appendicitis.—Ed.]

The stay in bed depends upon the incision and whether or not drainage is employed. After the muscle-splitting incision closes completely, patients are out in 3 to 7 days, fifty per cent. in 5 days. Median and groin incisions necessitate confinement for 10 to 16 days; ninety per cent. out in 12 days. Cases requiring drainage in bed, 12 to 16 days. After careful observations of several hundreds of healthy patients who sat up on 3d to 5th day following an easy appendectomy through a small muscle-splitting incision, La Roque's judgment convinces him long confinement is not necessary for wound healing. He seriously challenges the belief that any postoperative hernia has ever occurred as a result of sitting up that would not have occurred as a result of vomiting, coughing, or sneezing while in bed.

Concerning postoperative hernia, he considers every case which has to be drained as having a rupture so soon as operation is performed. He has always instructed every patient to report if a hernia should occur, but since only one has so reported, is satisfied patients are a little timid about reporting unpleasant sequelæ. The opportunity to reexamine, in 3 to 6 months, a large proportion of the cases which had to be drained, and failure to find but one case, leads him to believe postoperative hernia is exceedingly rare following the muscle-splitting incision even if drainage has to be employed, provided we use small instead of large tubes and carefully place sutures between the tubes when more than one is employed. Two or three small holes would seem less apt to be followed by hernia than one large one.

Cyst. A *giant mucocele* was removed by W. G. Nash(8) from a man, of 64. There had been pain and vomiting for 2 days. On palpation there was rigidity of the muscles and tenderness over cecum. A swelling could be felt in the cecal region, but hyperesthesia and rigidity made it difficult to palpate. An incision was made over cecum, and a large elongated firm lump was then felt lying behind cecum and asc. colon, which suggested an enlarged kidney. This was found to be attached to the apex of cecum. It was removed, leaving an opening ½ in. wide. A pursestring was applied, and stump invaginated. After operation vomiting continued for several days, which caused a good deal of exhaustion and difficulty in feeding. The man left the hospital quite well. The cyst 7x7.5 in., weighed 8½ oz.

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(8) British Med. Jour., Nov. 8, 1919.

[In addition to the large size, this case is of interest on account of the patient's age. Many years ago Ribbert showed that a good proportion of appendices are obliterated late in life. However, the present example was probably of long standing, for Nash states the walls were "extremely thickened," while in these cysts they are usually thin and translucent.—Ed.]

Carcinoma. A case in a girl, of 12, was operated on by J. E. Adams.[9] She was rather thin and nervous, with a history of "bilious attacks" for some years. In November, 1918, he was consulted and the diagnosis made was appendicitis owing to the location of pain and tenderness in r. iliac fossa. Abdominal pain on previous occasions had not been referred to this region, and the child stated the pain was "in a new place." The pain persisted in slight degree up to the operation (January, 1919). The appendix, however, proved to be quite free from adhesions but enlarged near its distal portion for .75 in. The proximal part was empty and healthy. Macroscopically the condition was taken for tuberculosis, as the lumen was obliterated and the mass yellowish-white. Microscopically it was spheroidal-celled carcinoma, with extreme invasion of the muscular coat and no clear evidence it originated in mucosa. Appendectomy. Perfectly well at time of report.

In addition to this case he has been able to find but 3 others (all females) in over 7000 appendectomies at St. Thomas Hospital in 17 years. One operated on at 14, was free from recurrence 14 years later. Another, aged 33, was free for 3 years, then lost sight of; the last, another girl of 12, could not be traced.

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(9) Lancet, May 17, 1919.

[Adams comments on the scarcity in England compared with the U. S. This is evidently due to the fact "microscopical examination of the organ was not undertaken as a routine practice."—Ed.]

THE RECTUM AND ANUS.

Extradural injection of novocain by the intrasacral route is advocated by S. R. Meaker.[1] Anesthesia of the 3d and lower sacral and coccygeal nerves is produced. The motor roots are not affected, and retention of urine after hemorrhoid operations done with sacral injection is neither more nor less common than when a general anesthetic is given. The regions supplied by the 1st and 2d posterior sacral nerves may undergo a paresthesia, but are not anesthetized. This may be because the upper nerves run free for a comparatively short distance in the sacral canal, or because they are large trunks and do not readily absorb surrounding fluid. The proven field of usefulness for sacral anesthesia comprises hemorrhoids, fistulæ, and other conditions in and about anus. In such one may employ the method with a practical certainty of success provided the technic of injecting the sacral canal has been mastered. The extent to which the buttocks are involved varies considerably. In some the anesthesia is limited to a circle around anus 3 or 4 in. in radius, while in others almost the whole of the buttocks may be analgesic. There is usually bilateral symmetry of effect. The lower rectum is anesthetized for at least 3 in. above anus.

Injuries. In addition to a general review of *impaling injuries,* C. J. Habhegger[2] reports a personal case: A man sat on the handle of a hammer, which entered the anus, tearing the rectum superficially and injuring the prostate. Severe hemorrhage at once, checked by tampon. In 24 hours symptoms of peritonitis developed. However, laparotomy disclosed no penetration of peritoneum or colon or injury to bladder, and wound was closed with drainage. Death from purulent peritonitis

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(1) British Med. Jour., May 10, 1919.
(2) Railway Surg. Jour., June, July, 1919.

on 5th day. Even at necropsy no perforation could be discovered, and Habhegger believes the infection must have come from prostate by contiguity.

According to W. J. Mayo,[3] an *excellent and most satisfactory laxative* in wounds and injuries about the rectum, such as those following operations, especially for hemorrhoids, is one prescribed by Van Buren in 1866:

Magnesii Sulphatis,
Magnesii Carbonatis,
Potassii Bitartratis,
Sulphuris Loti *aa* 30.0.

Sig. two drams more or less as needed at night with glass of milk or water.

Successful *cerclage (hooping) of the anus for prolapse* in a man, of 54, is recorded by H. de B. Barss.[5] Silver wire No. 19 was used, and the last report 4 months later stated there had been no relapse.

[This is neither "new," nor "untried," as claimed by the young—and therefore enthusiastic—author. It was originated by Thiersch long ago; in fact, Teirlinck's modification was described as far back as the 1909 volume (p. 450).—Ed.]

Fistulæ. In one of his interesting travel-talks, W. J. Mayo[6] alludes to the *method of locating fistula*, introduced by Goodsall: If a line is drawn transversely through the middle of anus, all fistulæ anterior to that line will pass directly from the external opening on skin to the internal one inside the anal canal, and all posterior to that line will have the internal opening in the midline of the anal canal, posteriorly, no matter where or how many lateral openings, the so-called "horseshoe" fistulæ are present. In the anterior fistula, therefore, the external opening will be opposite the internal one. An anterior horseshoe fistula, as Edwards remarks, is practically unknown. The cause of the curved or angular shape of the posterior fistulæ is the arrangement of the coccygeal ligaments and muscles which protect the external tissues in midline posteriorly and direct the

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(3) Minnesota Med., June, 1919.
(5) Jour. Michigan State Med. Soc., January, 1919.
(6) Minnesota Med., June, 1919.

pus laterally; the horseshoe tracts are thus formed. One sometimes meets with very superficial fistulæ in which the internal and external openings are in the same line posteriorly, but in such instances the internal opening is external to the sphincter just under mucosa.

W. W. Keen[7] furnishes the final outcome of *the amazing case,* first reported in 1876, in which a patient for 35 years urinated, and for 12 years menstruated by the rectum. After several failures of plastic operations for repair of vesico- and rectovaginal fistulæ (following typhoid), Keen closed the vagina entirely in 1875.

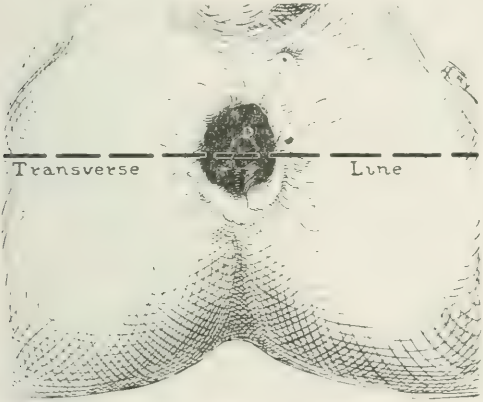

Fig. 145. Fistulas lying anterior to transverse line, passing from skin directly to mucosa (Mayo).

After the operation fistulæ in the cicatrix broke out in 1877, 1896, and 1904. Usually they caused only a little leakage and only when erect. Once the fistula healed spontaneously, once after a minor operation. In 1904 it closed on removal of some small urinary concretions. At her death May 24, 1911, at the age of 73, she had remained dry and well, with the exception noted, for over 35 years after closure of vaginal outlet. During all this long period she urinated only once or twice at night and 5 or 6 times during day. No ascending renal, vesical or uterine infection occurred at any time, nor

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(7) Annals of Surg., June, 1919.

did rectal mucosa at any time resent the constant presence of the urine or periodic presence of the blood.

[This is an extraordinary case from several aspects, but especially as regards non-occurrence of ascending infection.—Ed.]

Tumors. A *malignant cystadenoma*, weighing about 3 lbs. was removed from the rectosigmoid junction by W. T. Black.[8] The patient, a woman, of 59, had had pain for about 4 years off and on, and enlargement of abdomen for 2 years.

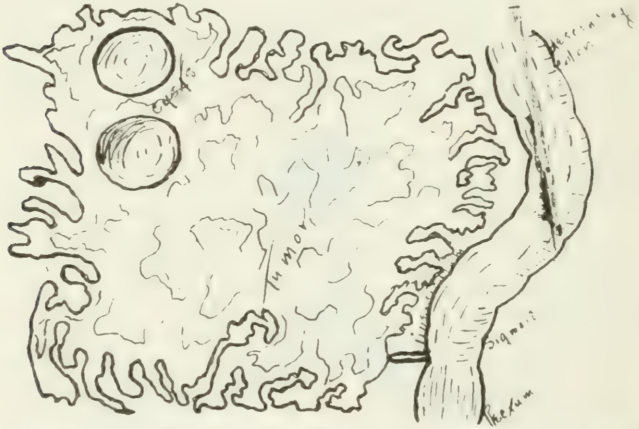

Fig. 146. Rough sketch showing attachment of tumor to diverticulum (Black).

[Most of this article on "congenital diverticula of the intestines" is devoted to the Meckel type. This, of course, is ruled out for the large bowel, the omphalomesenteric duct joining the small bowel.

In fact, it may be doubted if there was any true diverticulum, it seems just as likely to have been a pouch formed by traction of the mass on the bowel wall.—Ed.]

Carcinoma. The *end-results of operations* are taken up by J. R. Pennington[9] with suggestions for improving them. The old perineal operation occasionally furnished

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(8) Surg., Gynecol. and Obstet., May, 1919.
(9) Jour. Amer. Med. Ass'n., Dec. 7, 1918.

good results, and he cites Dent's case (1905 volume, p. 411), in which a man, of 52, lived 22 years. Pennington has collected 997 necropsies on cancer of the rectum, and in about one third (324 cases) the regional nodes were affected. They would be beyond reach, as a rule, by the perineal or Kraske operations.

To prevent cancerous material being forced into the lymphatics at the operation, it is a well recognized procedure in cancer of the mamma, *e. g.*, to begin the dissection from above and work down against the lymph current; and the same should hold good in excision of the rectum. Obviously this can be done only by the abdominoperineal route. In regard to the distribution of the lymph vessels, this may be stated as ending in the inguinal nodes for the perianal collectors, and in the nodes of the mesosigmoid from the rectum proper. Here again the latter would be out of reach in many instances if sought for by the "low" operation.

A frequent cause of death following operations by the perineal or sacral method is gangrene of the bowel, either partial or complete. This is due to the fact that the sup. hemorrhoidal are end-arteries, and can be avoided by the combined operation in 2 stages. In the first, in addition to ligating the vessels, one is able to clean out the presacral tissues, nodes, etc., which may be invaded. The second stage is excision through the perineum.

No better argument for the combined operation may be made than 2 cases referred to by Cole. In one there was a deposit in the pericolic connective tissues 3 in. above the rectal growth, and he points out if the latter had been excised together with 1 in. of normal bowel above, the incision would have passed close to the other deposit. In the other, a malignant ulcer was present on post. wall, and though small, microscopic examination showed it had spread freely into the connective tissue and nodes of the mesocolon. Another argument is that the growth in the rectum may be secondary to one higher up, and the latter escape detection.

In conclusion, Pennington reiterates some suggestions made over a decade ago before the American Proctologic Society, which still hold good. First of all, every person who has reached the so-called "cancerous age" should be examined periodically for evidence of commencing carcinoma, not necessarily of the rectum alone, but, in women, *e. g.*, of the uterus and mamma also. Neither the patient nor the practitioner should allow his interest in these periodic examinations to slacken. The responsibility of the family physician is great, for he is usually the first one to be consulted.

It has been shown of late years that a large proportion of malignant growths originate in scar tissue. Patients with rectal cancer often give a history of previous operations on the bowel. Does the cancer occur in the cicatricial tissue from an operation, leaving much scar tissue, and sometimes stricture? May it not be occasionally grafted on the scar after the common incision plan for fistula? All proctologists have seen large and ugly scars from time to time following this method. Here is a suggestion to be followed: Secure a smooth healing by resorting only to such procedures as leave a minimum of cicatricial tissue, and consequently the least possible nidus for future mischief.

As regards *operations in rectal carcinoma* I. Back[1] concludes only 30% of cases admit of radical operation when first seen. When radical operation is impossible, a hypogastric colostomy should be done *at once.* Radical operations which aim at retaining the anal canal are pathologically unsound.

The only sound radical operations are: (i) the two-stage operation (colostomy and intraperitoneal excision by the perineal route later); and (ii) the combined abdomino-perineal operation.

Of these, the former is the better except in a growth situated at the junction with sigmoid.

HERNIA.

In *examination of 5000 applicants* for R. R. service, A. W. Rudisill[2] found 397 with one or more hernias: Umbilical, 121; Right inguinal, 115; Left inguinal, 94; Double inguinal, 22; Double inguinal and umbilical, 8; Ventral, 6; Femoral, 4; Inguinal, not specified, 25.

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(1) Lancet, Sept. 6, 1919.
(2) Memphis Med. Monthly, August, 1919.

The majority of strangulated hernias seen have not been in persons with a history of violent physical effort, largely in men, who do not lead an active life, and in women. Of the umbilical hernias 119 were in negroes.

An unusual example of *imperfect obliteration of the processus vaginalis* came under the notice of C. F. M. Saint,[3] in a child about 3. Admitted with a double inguinal hernia, which was only partially reducible on either side, and reached to the upper scrotum, the testis being free at the bottom of scrotal sac on either side. On r. side a fairly large funicular sac was found containing coils of gut, and below this, between it and testis, were two hydroceles of the cord, not tense, and containing about 1½ drams of fluid. The apex of the hernial sac projected into the first hydrocele sac, and this in its turn projected somewhat into the second. The testis with t. vaginalis was quite separate. On l. side there was a similar, though less, funicular hernial sac with gut content, and below it a single hydrocele of cord, of similar size. The hernial sac projected into the hydrocele in a manner similar. The testis was here also quite free. On both sides the hydrocele and hernial sacs were removed, the necks being ligated, the ext. oblique sutured with catgut and skin with silkworm-gut.

Concerning the *dynamics of abdominal hernias*, H. R. Trick[4] states the most potent force in their production lies latent *inside* the bowel and is applied from within, outward, *i. e.*, increased intravisceral pressure due to concentric compression exerted by the abdominal wall. Development defects do not cause herniæ, but they represent the sites of potential herniæ and are more probably the result of this force applied during intrauterine life. Proper repair of the transversalis fascia determines the integrity of the wall at that point.

Reference is made by A. MacLennan[5] to *adrenal rests in walls of hernial sacs*. During 700 radical cures on children small nodules were found on 8 occasions, once bilateral. They were practically all same size, ⅛ in. in diameter, embedded in the wall near, but not attached

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(3) Edinburgh Med. Jour., June, 1919.
(4) New York State Jour. Med., May, 1919.
(5) Surg., Gynecol. and Obstet., October, 1919.

to, the cord. They appear as brownish-yellow, flattened spherical particles, having a pearly appearance. They superficially resemble fat lobules. So far only one nodule has been detected on each sac. Once found loose inside the sac but doubtless it had become displaced there. These fragments are also readily detached. The sacs on which these rests have been found have been with one exception typically so-called acquired ones; the exception being a congenital hernia, *i. e.*, one where the tunica vaginalis and sac were common. A specimen has not yet been found in the corresponding sac of female; but only about 40 cases were in this sex. This is interesting as accessory adrenal tumors are commoner in the female. None yet observed in an adult hernia but the cases have not been so numerous. The fate of these nodules is uncertain, probably they atrophy; they do not evidently give rise to tumors later on. The removal has not been detrimental.

The observation is also of interest as corroborating the saccular origin. Adrenal rests are sometimes found along the cord or in association with the testis, but their presence attached to a sac claimed to be acquired negatives such a supposition.

[These "rests" in addition to the kidney itself, and the tissues in the vicinity, have been discovered in the mesentery, liver and pancreas, in the broad ligament, ovary, along the spermatic vessels, along the inguinal canal, and in the testes. In short, somewhere between the primitive location of the gland and that finally assumed by the sexual gland. In early embryonic life the adrenal is in intimate relation not only to the primitive kidney, but to the future sexual glands as well.—Ed.]

Technic. H. B. Boyden[6] tells of his experience in *herniotomy under local anesthesia* (novocain). The technic is to infiltrate the skin incision using a hypodermic needle. Then the subcutaneous tissue using a needle 15 to 20 gauge, 1.5 in. long. Then insert needle perpendicularly to skin, penetrating the aponeurosis and infiltrate this subaponeurotic area. In 5 min. make the incision through the skin, fat and the aponeurosis. Upon the exposed surface of int. oblique can be seen the

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(6) Nebraska State Med. Jour., July, 1919.

branches of the iliohypogastric nerves which are blocked with a few minims of novocain at the upper end of wound. This also makes one careful as having seen these nerves he will not cut them as is so often done under general anesthesia. The int. oblique and the coverings of the cord are infiltrated, blocking any filaments of the genitocrural over the cord. The subserosa of sac is injected; if sensitive, an injection of the periosteum around pubic spine will avoid any pain in the pubic reflection of Poupart's lig., whose innervation is from 12 D. nerve. Just prior to cutting and tying off Boyden injects the neck of sac.

The *anatomic incision for groin surgery,* advised by J. N. White,[7] commences on Poupart's ligament .75 in. from pubic spine, and extends at r. angle to ligament for 3 in. toward umbilicus, gives access at once to the inguinal canal and round lig. and extension down and slightly in exposes femoral ring. If a femoral has been mistaken for an inguinal hernia or vice versa (and every surgeon of experience has made this blunder, especially in strangulated cases), no new incision is required nor extensive prolongation of the one already made. It is a bloodless incision. The incision is parallel rather than across the blood and lymph vessels. Leaving the blood and lymph supply intact, infection is less frequent. Any operation in the inguinal region can be performed through the one incision, including appendectomy. A common cause of infection is the catgut knot; in the anatomic incision, there are no knots.

An easy approach in operation for strangulated hernias is described by J. A. Hendrick.[8] The most competent surgeons use the method of approaching the sac and relieving the constricting band. This is very difficult and time-consuming in some cases, and occasionally the intestine is punctured. Some years ago he made the incision as in an ordinary non-strangulated hernia, separated the tissues down to the peritoneum, just above the int. ring, entered the free peritoneal cavity about 1 in. internal to the constricting band, introduced a finger through constricting ring, divided it over finger, sepa-

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(7) Pennsylvania Med. Jour., June, 1919.
(8) New Orleans Med. and Surg. Jour., July, 1919.

rated the adhesions easily with fingers, and dealt with the condition as in ordinary hernia. It makes a strangulated inguinal hernia, where the parts are swollen, discolored and adherent, as easy as the simple hernia, and saves time, which is an important factor. And is just as applicable under local as under general anesthesia.

A step in the *technic of inguinal herniotomy* is suggested by M. Pitzman.[9] All types of hernia are caused by greater intra-abdominal pressure than the particular wall can withstand. The newer point of view, that the hernia causes the sac, in contradistinction to the sac causing the hernia, deserves serious consideration. Greater operative emphasis should be placed on the repair of the musculo-aponeurotico-fascial layers of the wall. His suggestion is that sutures for the repair of wall be placed before the peritoneal cavity is closed.

Some *hernia problems* are dwelt on by W. Van Hook.[1] The radical cure of hernia by suturing the ring from within the abdomen during an ordinary laparotomy was first attempted by him some half a dozen years ago. A patient was referred with a diagnosis of ovarian cyst and femoral hernia. Examination confirmed the diagnosis and at operation a grape-fruit sized cyst removed through a median incision. Upon examining from within the open abdomen the femoral canal the well marked hernia was found to contain omentum which, in the amount of a walnut-sized mass, was easily drawn back into abdomen. The omentum was amputated at the point of constriction at the neck of sac. The sac was pulled upon by forceps, and an opening was made in its wall with scissors, allowing a finger to pass out into the loose preperitoneal fat. The sac was then easily loosened throughout, inverted and amputated. Since the patient was not obese, the r. ant. abdominal wall was rather readily lifted with retractors and the femoral canal exposed with exactness. All the structures of the classic descriptions of femoral hernia were made out. Two heavy sutures of chromic gut were then passed through Poupart's lig. across the canal and then through the connective tissue of the inner wall of ring, the ves-

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(9) Surg., Gynecol. and Obstet., March, 1919.
(1) Bull. Chicago Med. Soc., March 22, 1919.

sels being pushed out by the forefinger. When the sutures were tied the canal was thoroughly closed without compression of the vessels. The hernia has not recurred.

An exactly similar experience occurred in a second case, where, after a routine removal of the appendix by a lateral incision, a femoral hernia was similarly treated.

A. J. Ochsner said he had practiced the closure of hernia through the abdominal wound in females in a number of cases. In regard to femoral hernia, he called attention to one point which he applied in this operation in a satisfactory manner. In the body, wherever we have a circular opening that is not lined with serous tissue or mucosa, it is practically impossible to keep such an opening open, and so in femoral hernia he has pulled the sac into the peritoneal cavity, has ligated it within the cavity, so no portion of the sac can slide back into the femoral opening, and then there was a circular opening which could not be kept open with a stick. It would close, no matter what was done, unless one changed the circular form of the opening. The same principle he has employed in many dozens of femoral hernia. His regular plan is to expose the sac, open it, replace what is in it, ligate it at its neck after drawing it out, cut it off, let the stump fall back into the peritoneal cavity, and sew the skin. Some years ago he sent inquiries to a large number on whom he had operated and not one has had a recurrence.

The *operative method for inguinal hernia,* by which F. Torek[2] has obtained almost 100% of cures, is described by him. It has been in use for 14 years, and in 600 cases there have been but 2 recurrences. Skin incision about 4 in. long above Poupart's lig. in the direction of the ext. oblique down to the pubis at ext. ring. Incision of ext. oblique in course of fibres, terminating in ext. ring where it also divides the intercolumnar fascia. Reflect outer margin of ext. oblique to expose Poupart's lig. all the way down to its insertion in pubis. Likewise reflect inner margin all the way down to pubis, at the lower end separating it from the rest of the rectus sheath. The border of int. oblique and transversalis muscles is freed of connective tissue and fat. Lift the

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(2) Annals of Surg., July, 1919.

cord out, liberating it on all sides and entirely loosening its attachments at brim of pelvis. Dissect vas deferens, spermatic vessels, and sac clean of connective tissue well up to int. ring, until the sac is seen to emerge between the vessels and vas, vessels above sac, vas below. Remove all lipomata and other fatty as well as connective tissue, from region of int. ring, allowing no structure, except vas and vessels, to be partly inside, partly outside abdomen. Empty the sac, transfix it at the highest point possible, tie, and cut off. Do not in-

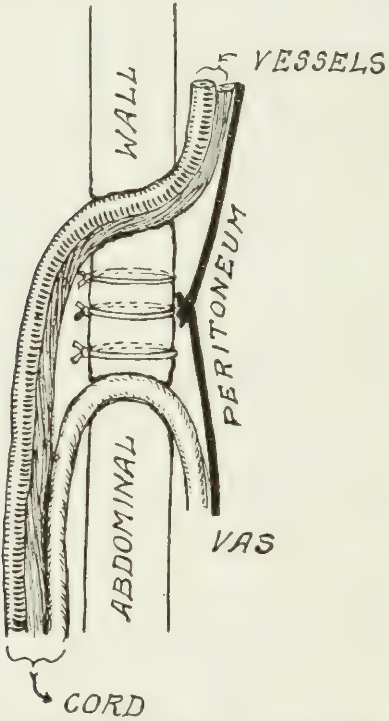

Fig. 147. Diagram of the upper part of the plastic. Note the vas and the spermatic vessels are prevented from meeting at the internal ring by the interposition of sutures between them—sutures which connect Poupart's ligament with the muscles (Torek).

clude cremaster in the suture. If unmanageable on account of bulk or a diffuse attachment to int. oblique, divide or resect it.

Before introducing the sutures, the spermatic vessels are placed in the uppermost angle and the vas in the lowermost angle of int. ring, these structures being kept apart by the sutures which unite int. oblique and transversalis muscles and fascia to Poupart's lig. between. In the average fairly large hernia there is room for 3 sutures between the vessels and vas; in very large ones more than 3 are inserted; in no case less than 2. These sutures, of which the highest is directly under the vessels, close the oblique hernia; below the point of exit of the vas additional sutures, extending all the way to pubis, are inserted for a direct hernia or the prevention of its occurrence. At the lower end of this section, the direct hernia section of the plastic, there is often no int. oblique or transversus muscle available, owing to their insertion in the rectus fascia higher up. In that case the rectus, with unopened sheath, is attached to Poupart's lig. The sutures are introduced 3/8 to 4/8 in. apart, greater tension requiring closer suturing. Observe the following points: The apposition of muscles to Poupart's lig. must be without interposition of connective tissue or fat or cremaster. The alignment must be absolutely accurate, *i. e.*, after the needle has penetrated the muscles, it should catch Poupart's lig. at a point directly opposite, not ½ in. higher or lower, as otherwise one or other tissue will tear. Carry the needle through Poupart's lig. gently, make a hole no bigger than needle. Do not pull needle through in straight line, it may split the fascia. Grasp a reasonable amount of muscle and full thickness of Poupart's lig. in suture. In tying knot aim at good firm approximation, no more, no less.

The material for lowest suture or 2 under some tension, is No. 26 silver wire or other non-absorbable material, for remainder chromic gut No. 3. All sutures are introduced before tying any. Begin with silver sutures, twist wire directly over hole in muscle, not over Poupart's lig. Get pull right on first twist, attempts at correction may break wire. A complete turn is necessary to hold parts when there is tension. Add two or three more, cut off to leave an end about $\frac{1}{8}$ to $\frac{3}{16}$ in. long, turn this with forceps to midline to lie on muscle, give distal end a second turn to embed point in muscle. Cure depends on perfect union of deep layer and on it alone. The suture of the next layer, the ext. oblique, is done in simplest manner without overlapping, using plain gut. Skin then sutured. Patient stays in bed 2 weeks, exceptionally longer.

[The statistical portion of this paper is not to be taken seriously, because three of the author's patients have come to our clinic with recurrence, and it seems unlikely that none should have gone elsewhere.—Ed.]

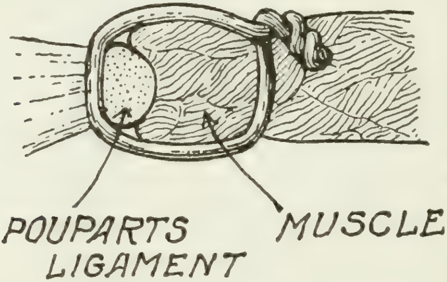

Fig. 148. Method of embedding cut end of wire into muscle—schematic (Torek).

The *technic used at the Mayo Clinic* almost 5 years by J. C. Masson[3] is a slight modification of the Andrews operation. The only exceptions are: (1) to follow the Ferguson technic in all hernias associated with undescended testes and in some instances in infants, (2) to utilize the rectus, in all cases in which the int. oblique is not sufficiently strong, (3) in a very few to follow the Halsted technic, and (4) in extradifficult cases, in old men, occasionally to cut all the structures of the cord at the int. ring, close the canal much as in a ventral hernia, and perform orchidectomy.

For unilateral ruptures the usual oblique incision is made, and in most bilateral cases, the transverse (Judd) is very satisfactory. The ext. oblique is incised about .25 in. internal to the inner pillar of ext. ring. This is then cut across, which gives a good exposure of the canal and also leaves sufficient aponeurosis in the lower flap to use later in covering the cord. Care is taken not to injure the ilio-inguinal or hypogastric nerves, and it is not advisable to separate the genital branch of the former from the cremaster. The cremasteric fascia with its enclosed cord structures and hernial sac (if present) is first freed from Poupart's lig. and the floor of canal then freed from the int. oblique and conjoined tendon.

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(3) Minnesota Med., October, 1919.

In indirect hernias the sac may always be found at the level of int. ring between the vas and the vessels. An incision about 1 in. long is made through this covering of the cord at the point and the sac is located and opened; it is generally an easy matter to reduce the contents and free the sac from the cord structures. If firm adhesions are encountered, rather than traumatise the cord or leave an extensive raw surface which would ooze considerably afterward, Masson cuts the sac close to its neck, and if the cut end of the distal section is left open, it will not lead to future trouble. The proximal portion may then be treated in the ordinary manner. Any preperitoneal fat tags accompanying the cord through int. ring should be ligated as high as possible and excised. Handle the cord structures as little as possible, in order to avoid postoperative pain and swelling. The neck is thoroughly freed from edge of cremaster and transversalis fascia and ligated as high as possible; the stump is transfixed to prevent the slipping of ligature, and distal portion cut off. The free end of the ligature for tying the sac is then threaded onto a large hand needle and by this is carried through the transversalis and the int. oblique about 1.25 in. above int. ring. By drawing the neck tightly up to this point and tying the catgut, the sac is prevented from causing pressure at the ring while healing is taking place. The opening in the cremaster is now closed and cord held by gauze while the canal is closed. In direct hernia, unless the sac is large, it is not opened but simply turned in with its preperitoneal fat and a few stitches placed in the base to prevent it pressing on suture line during healing.

The plastic closure of the canal is the most important step in prevention of recurrences in direct hernias and in all the difficult cases of the indirect type. The principle (Bassini) of bringing the int. oblique and conjoined tendon down to Poupart's lig. behind the cord, would probably be sufficient in all where these structures are well developed and the interval not too great. However, additional security is obtained by bringing the cut edges of the aponeurosis down to Poupart's lig. also. Additional strength is also obtained by the Andrews imbrication of ext. oblique, which, in addition, makes a covering for the cord. Marked atrophy of int. oblique is often seen in recurrent cases or when patients have worn a truss for a long time. In such cases it is frequently advisable to utilize either the sheath of rectus or the muscle itself. By freely slitting up the sheath (about 3 in.) it is always possible to draw the muscle fibers down to Poupart's lig. without undue tension. In most cases of this type it is advisable to cut the sheath of rectus posterior to the attachment of int. oblique, and the use of that muscle in strengthening the closure at int. ring is not interfered with.

The use of heavy absorbable and nonabsorbable material is more frequently an added danger than a safeguard against recurrence. The mistake frequently hard to guard against, is making the closure under too much tension, so the sutures cut through, and a recurrence results. Once healing is secure, nonabsorbable material remains as a foreign body and is a weakness rather than a strength. The closure is started at the bottom of canal, the first stitch going through the int. oblique (or conjoined tendon when present) close to its insertion into pubis and Poupart's lig. near its insertion. When this suture is tied, the structures almost approximate one another throughout the entire canal, and no tension is required to complete the closure by whipping the int. oblique to Poupart's with about 6 stitches. A fairly tight closure should be made at int. ring making sure there is little danger of constriction of the cord at this point. The approximation of the ext. oblique to Poupart's is then completed with the continuous suture, which is finished at pubic spine and tied to the free end at that point. As an occasional recurrence is directly above the cord where it emerges through the int. ring Masson puts a stitch in int. oblique and Poupart's at this point, being careful not to injure the nerves, which lie on the surface of the muscle. Continuing with the same suture one or two stitches are generally placed in ext. oblique above cord, imbricating the lower part of top of the upper, continuing down and enclosing the cord structures between two layers of the aponeurosis.

Hemostasis is very important and after tying all visible vessels the space between the skin and ext. oblique is obliterated as nearly as possible by closing the subcutaneous tissue with a continuous plain No. 1 gut suture, and frequent catches into the ext. oblique.

It is not necessary to use tension stitches and close skin with continuous horsehair. A light gauze dressing is applied and a suspensory put on scrotum. Most of the postoperative pain and swelling is due to oozing or unnecessary handling of the cord and testicle. The majority are allowed to get up on 8th day, but in the worst cases, including all recurrent hernias, are kept in bed about 14 days. Light work is allowed in 6 to 8 weeks and heavy work in 3 to 6 months. (Plates XXXIV to XLI).

The *two-stage operation in strangulated femoral hernia* is outlined by E. H. Risley[5]: Anesthesia preferably local; opening of sac to determine condition of contents; stretching of femoral ring, possibly further aided by nicking Gimbernat's lig.; pulling down of healthy intestine; resection of devitalized gut; insertion of Mixter tubes into each cut end; stay sutures holding intestinal ends well outside of wound; small drainage wicks; closure of skin to tubes; after 3 weeks, local anesthesia; careful freeing of ends of intestine from edges of wound; further stretching of contracted tissue about femoral ring; end-to-end anastomosis; cleansing of joint; return to abdominal cavity through relaxed femoral opening; radical cure of hernia with drainage to superficial tissue only. Three recent cases by this technic made splendid recoveries when the chances

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(5) Annals of Surg., July, 1919.

seemed poor and a femoral and an inguinal, done over a year ago, show no signs of recurrence to date.

The principal advantages of the method described and used in 12 cases are: Shortest and least traumatizing primary operation possible when the patient is in poorest condition. Great benefit from prompt and continued drainage of the strangulated gut. Minimum risk of peritonitis; the operation being practically extraperitoneal and the risk from infection practically *nil.* Avoidance of cutting structures like Poupart's lig. which do not tend to heal readily and the obtaining of sufficient room for reduction of the hernia—or for resection and later repair—by stretching the femoral ring. The strong evidence against opening the abdomen elsewhere to do resection or anastomosis as evidenced by the high mortality in the one-stage operation.

It is, of course, realized that the advocacy of the two-stage, draining-*in-situ* operation admits of the probability of more or less local sepsis in the hernial wound, but results so far, both immediate and at the end of a year, still lead him to believe the risk is of comparatively little importance in comparison with the benefits from the drainage effected and the lowered mortality.

Inguinal Route for Femoral Hernia. This plan was devised by Lotheissen, and is described by P. P. Cole[6] who used it in *10 cases of strangulation:* The incision is that employed in inguinal hernia. It should be free and prolonged at its lower end. The ext. ring is defined together with Poupart's lig. and the aponeurosis divided throughout the length of inguinal canal (*A*). The arching fibres of the conjoined tendon are cleanly demonstrated, the cord or round ligament defined and dislocated from its bed. An incision is then made through transversalis fascia where it forms the post. wall of the inner part of the canal (*B*). The extraperitoneal fat is thus exposed and the deep epigastric vein lying well to the inner side of artery is sought for at outer end of incision. This vein marks the outer edge of the peritoneal diverticulum that leads to the femoral ring. The finger can then be passed behind the neck of sac and made to emerge in wound on inner side. If it

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(6) British Med. Jour., June 21, 1919.

is clear that nothing is passing through the neck from the peritoneal cavity, an endeavor is made by blunt dissection and gentle traction to deliver the sac from thigh. In (*C*) this has been done, and the unopened sac is presenting in wound. The sac is opened and ligated at or above junction with the peritoneal cavity (*D*). The iliac vessels are then pulled out and femoral ring clearly defined. Three sutures are then passed through the conjoined tendon above, and below through the post. thickened margin of the ring. The outermost of these sutures lies close to the vein and should be inserted first (*E*). The passage of these sutures is quite easy if a small half-circle needle be used. When tied, these sutures bring the conjoined tendon in contact with the post. boundary of ring, and a new bed for the cord or round ligament is thus constituted. No attempt is made to close the ring. All direct communication with the peritoneal cavity is abolished—the femoral ring opens into the musculature of the ant. abdominal wall (*F*). The remaining structures are united as in an inguinal hernia. It happens fairly frequently that, though empty, the sac can-

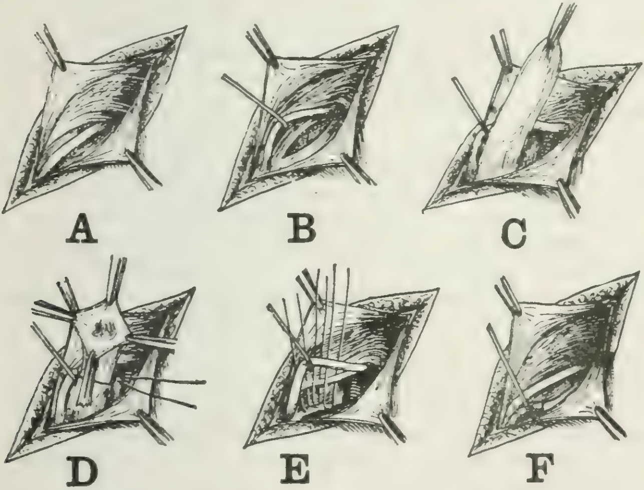

Fig. 149. Inguinal route for femoral hernia (Cole).

not be delivered easily. In this case the neck is cut across, and the hole in peritoneum sewn up as usual.

Cole sums up the advantages as: Providing a certain cure. Permits a direct view of the structures. Abnormal conditions can be recognized and dealt with. Resection can be undertaken through original incision. Is neither difficult nor complicated.

H. Fischer[7] *used this route* in 37 cases. Five cases have been reëxamined after 3 years, seven after 5 years, three after 6 years, one case after 8 years, one case after 9 years, five after 4 to 5 months. No recurrence.

Inguinal Route for Obturator Hernia. This is recommended by E. T. C. Milligan[8] after experience in a recent case: The man complained of dull pain over the inner portion of Scarpa's triangle, with indefinite tenderness over pectineus muscle; the symptoms were aggravated by any sudden turning of the leg out. Had been treated at several hospitals, but symptoms unrelieved.

An oblique incision was made exposing the external ring and the attachment of aponeurosis to Poupart's lig. The aponeurosis was incised and upper part retracted. The cord was also drawn up out of the way and ext. iliac vein and femoral ring defined. With deep retractors the peritoneum was pushed up from pubic bone, when, about 1 in. behind femoral ring, could be seen and felt the obturator foramen, through which the obturator nerve disappeared into thigh after running along the wall of pelvis in a conspicuous manner. The sac was drawn from the foramen without difficulty and its obliteration assured by this approach.

The method is eminently suited for this class of case, but would not be recommended for strangulated obturator hernia, because it could not be diagnosed clinically with certainty as the origin of the mischief. This would call for laparotomy to treat the cause.

The operation suggested by C. L. Gibson[9] is applicable to any form of *ventral or umbilical hernia* and particularly in large postoperative incisional herniæ. The essential step was the utilization of pedunculated flaps of

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(7) Annals of Surg., April, 1919.
(8) British Med. Jour., Aug. 2, 1919.
(9) Annals of Surg., June, 1919.

the ant. sheath of rectus, these flaps being cut exactly as are Langenbeck's flaps for cleft palate. The length and width varied according to circumstances, but the result must always be the possible approximation of the refreshed free edges as in ordinary suture of abdominal wounds. The rest of the operation—closure of peritoneum, dissection of recti, etc.—the same as in ordinary laparotomies. It would seem at first sight that a weak place was left by the gap in the fascia of rectus. Ordinarily, the muscle underlies this and there was no trouble, but even in cases with such a deficiency, the results had been uniformly good. He believed this operation is suitable for the repair of any hernia unless it is an umbilical hernia, and even for an umbilical was surer than the overlapping operation.

A. M. Miller[2] takes up *treatment of the sac.* High ligation and amputation is a point on which most surgeons agree. To be certain the sac does not contain intestine or omentum, it is usually opened widely and ligation made under the guidance of the eye. If a patient is straining or distension is present this may be difficult. Any appliance which would add to the safety of high ligation is welcome. The Allis pick-up forceps is usually found in the ordinary operating set. After its application around the sac the smooth spring blades are approximated until the peritoneal surfaces are in apposition. By firm pressure against the abdominal muscles a much higher ligation may be made than usual.

Strangulation. In the 900 abdominal sections detailed by K. A. Lees,[3] *283 were for hernia*—234 inguinal (100 children), 34 femoral, 15 umbilical or ventral.

Of the inguinal, 82 were strangulated, of the femoral 20, and of the umbilical and ventral 6. Only 3 needed resection, 2 inguinal and 1 femoral; and one died. In many cases the gut was returned doubtful, but nevertheless they recovered; it is unlikely so many would have recovered if more resections had been done. In one case only he regretted not having done resection, but taking all things into consideration these cases are best dealt with somewhat conservatively. In one strangulated fem-

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(2) Surg., Gynecol. and Obstet., August, 1919.
(3) Practitioner, October, 1919.

oral hernia (Richter), the gut slipped back before it could be drawn down for examination. Lees decided to open the abdomen and search for the injured loop. He found it in pelvis, with the ulcerated portion leaking and the contents being steadily poured out. The pelvis was drained, and patient recovered.

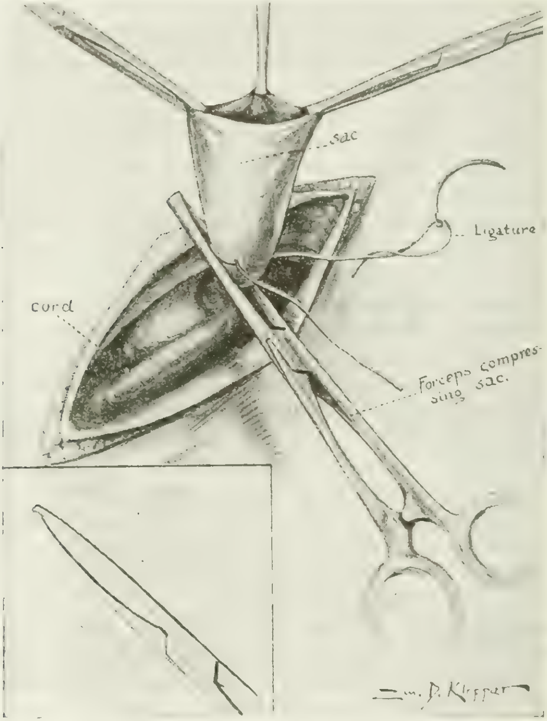

Fig. 150. Treatment of hernial sac (Miller).

A successful Bassini was done by J. E. Fuld[4] on a *baby, only 14 days old.* Strangulation is rare in infants, but once in 1200 during a year at the Hospital for Ruptured and Crippled. Strangulation practically always

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(4) New York Med. Jour., Feb. 8, 1919.

occurs in large scrotal hernias, uncommon in infants. Other reasons for the scarcity are they occur from loose and easily dilatable pillars of the ext. ring; also, the hernia has not existed long enough to become adherent.

Mothers and nurses should be warned against giving castor oil, as soon as the child shows symptoms of abdominal pain, without first being examined by a physician. The promiscuous administration of purgatives is equally injurious in appendicitis and intussusception. We know that in at least 75% of the cases of appendicitis, perforation has followed the use of cathartics. It is Fuld's opinion that the administration of a purgative was the cause of strangulation in this case. The danger of allowing hernias to remain unreduced should be impressed upon both mother and nurse. In infants under a month old the wool truss makes an efficient support not obtained by a truss with steel frame. If strangulation has existed long, taxis is more dangerous than operation. Operation of itself presents very little danger; the interesting feature is the excellent way in which the babies stand the operation. The fine instruments employed by the ophthalmic surgeon are the most practical in handling these delicate tissues. Operating early on infants under ether is attended with very little danger.

In an operation for hernia by A. A. Matthews,[5] in addition to the strangulation there was *mesenteric thrombosis.* The patient, aged 33, had undescended testis and congenital hernia in r. side; never wore a truss. April 23, while working began to have pain and vomited. Operation about 5 hours after onset, about 24 in. of bowel edematous and very dark. Upon further examination found the mesentery also thick and dark, resembling an encapsulated blood clot, triangular, base corresponding to the involved gut. This area was resected and end-to-end anastomosis made. The wound was closed with no attempt to cure the hernia or take care of testis, as patient was in considerable shock.

Wound healed primarily and patient sent home thoroughly to recover before completing the operation. After being home 3 days he developed obstruction; was brought back and operated upon at once. Found a kink in the

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(5) Northwest Med., July, 1919.

ileum, due to its being bound down by adhesions to the mesentery. This was released, testis removed, and hernial orifice sutured; uneventful recovery.

Details are given by W. F. Stiell[6] of supposed *spontaneous cure of strangulated hernia.* A man, aged 37, had a swelling in groin for 5 years. In December, 1917, had suddenly increased in size, become both painful and tender, and could never again be reduced. There was at that time some generalised discomfort, but no vomiting, constipation, or other symptoms to suggest any obstruction. On admission Feb. 4, 1918, all abdominal symptoms had disappeared and there were no abnormal signs in abdomen. Near l. cord, just below ext. ring, there was a hard, non-cystic tumor. Neither painful nor tender. It was impossible to reduce it, either into abdomen or into scrotum. The testicle itself was unaltered, and a normal vas could be traced up.

Operation next day, showed mass occupying the canal with the aponeurosis and ext. ring stretched tightly over it. The tumor itself was everywhere surrounded by a thickened peritoneal investment, to which it was closely attached by old adhesions. The various constituents of the cord were post. to tumor, and abnormally adherent to its peritoneal lining. When traced up the peritoneal coat gradually merged into a small strand of dense fibrous tissue, and the int. ring was solidly occluded. The cord was thoroughly isolated, and the operation completed of radical cure. Although no peritoneal neck to the sac could be ligated at int. ring, there has been no recurrence after 18 months.

Microscopic examination was performed by a pathologist, who was intentionally given no information of the case, and he stated "this is a mass of fat showing fibrous alveolation. It is undergoing fibrous degeneration and inflammatory infiltration. No evidence of tubercle or new growth. There is no evidence to show how it has originated." Taking into consideration the history, findings at operation and the histologic examination, Stiell thinks there can be little doubt the tumor owed its origin to an omental plug in the strangulated epiplocele, which had undergone aseptic ulceration at

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(6) Lancet, Sept. 20, 1919.

the int. ring, with subsequent complete stenosis. It therefore, at the time of operation, possessed no actual connection with the main mass of omentum.

A case of hernia of the pelvic colon with *strangulation due to volvulus,* was successfully operated on by B. Hughes.[8] The gangrenous portion was resected and end-to-end union made.

Recurring Hernia. In his consideration of this subject, J. C. Masson[9] informs us that of 7,016 cases at the Mayo Clinic, there was a little less than 1% following cord transplantation, and a little over 1 after the anatomic operation. Of 5,364 inguinal hernias operated on (1907-Dec. 31, 1917), 2,234 were on right, 1,430 on left, and 850 bilateral. There were 330 for recurrence, (260 elsewhere, 70 from Clinic), including 29 bilateral, counted as 58. The number of previous operations was one, 258; two, 44; three, 20; and four, 8.

The hernias particularly difficult to cure are those, either direct or indirect, associated with a poorly developed int. oblique, and this type can always be determined by examination through the external ring. The normally developed int. oblique and conjoined tendon (when present) can readily be felt and the distance between these structures and Poupart's lig. accurately estimated. In the other cases, the reverse is true, and in the worst cases no resistance is encountered until the edge of the rectus is reached. Another hernia difficult to cure and yet indirect, is the one so often found in old men with a large mass of omentum or omentum and bowel descending into the scrotum, and who have probably worn a truss for many years with complete satisfaction until the last few months. In these cases the deep epigastric vessels are drawn down almost to the pubes and the internal ring is directly behind the external, with marked enlargement of both rings, and surrounding tissue very poor for plastic work. The direct-indirect, saddle bag, bilocular or pantaloon hernias, as they are variously called, present no difficulties that are not common to all direct hernias, except it is also necessary to remove the part of sac that accompanies

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(8) British Med. Jour., Oct. 25, 1919.
(9) Minnesota Med., October, 1919.

the cord. as well as to treat that portion which comes through the transversalis fascia below the deep epigastric vessels. The operation for sliding hernia is always difficult on account of a large internal ring. and after the removal of as much of the sac as possible, the bowel still protrudes and when returned tends to make a constant pressure on the line of closure of the canal.

More than half of all recurrences were in patients over 40. clearly showing that any operation is satisfactory in children and young adults, but in older persons the strongest possible closure must be made.

Of 256 cases, 189 recurred in the first six months, 26 between six and twelve months. 19 between one and two years, and 22 between two and eight years. If a hernia recurs within 6 months, either the operation was not sufficient, or patient over-exercised after operation. On the other hand, recurrences after 12 months are more apt to be due to the development of a new hernia as the result of stretching in scar tissue or atrophy in the muscles. One cause for this is, without doubt, the wearing of trusses following operation, and another cause is injury to the iliohypogastric nerve, with resulting atrophy in int. oblique, which frequently occurs at the time of the first operation and, as Balfour has shown, may also be the result when on r. side, of a gridiron incision for appendicitis.

Hernia Complicated by Appendicitis. After giving 5 case-histories, L. H. Kornder[1] remarks whether these were cases of appendicitis primarily and as a result caused the irreducible hernia is hard to say. One is tempted to believe this in Case 4, here the operative findings within 2 hours after the initial formation of hernial mass, showed an acute pus appendix. Consideration of the other cases, however, would lead one to believe the appendicitis was the result of the extreme venous congestion and edema existing in the incarcerated bowel. Possibly these factors furnished the necessary media for the ever-present bacteria. Especially so since in all the pus was due to the colon bacillus.

It is further of interest to note the age-incidence is of no importance. True, all were adults but their age

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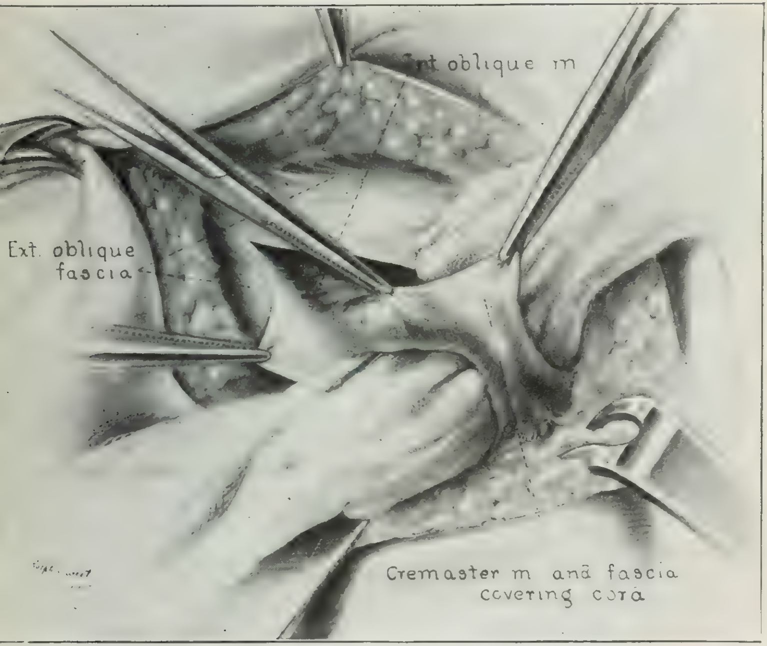
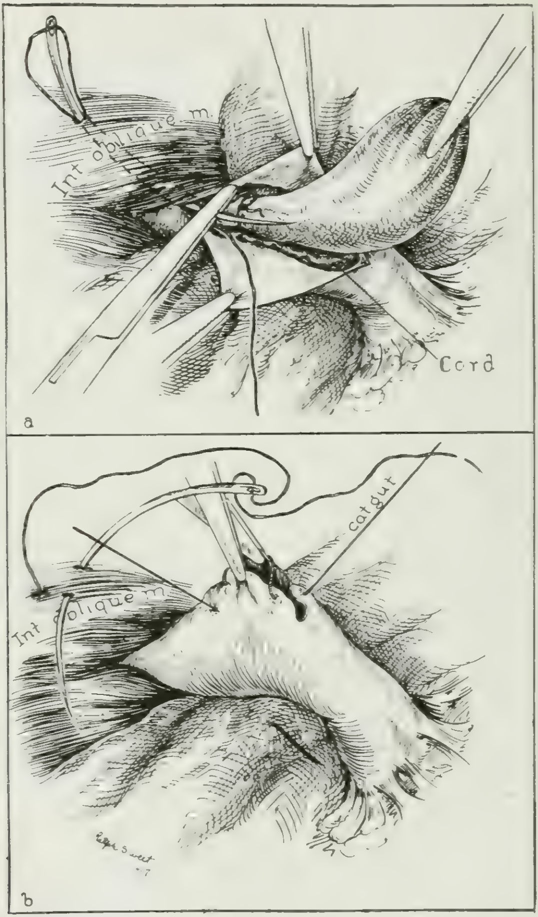
(1) Jour. Iowa State Med. Soc., July, 1919.

PLATE XXXIV.



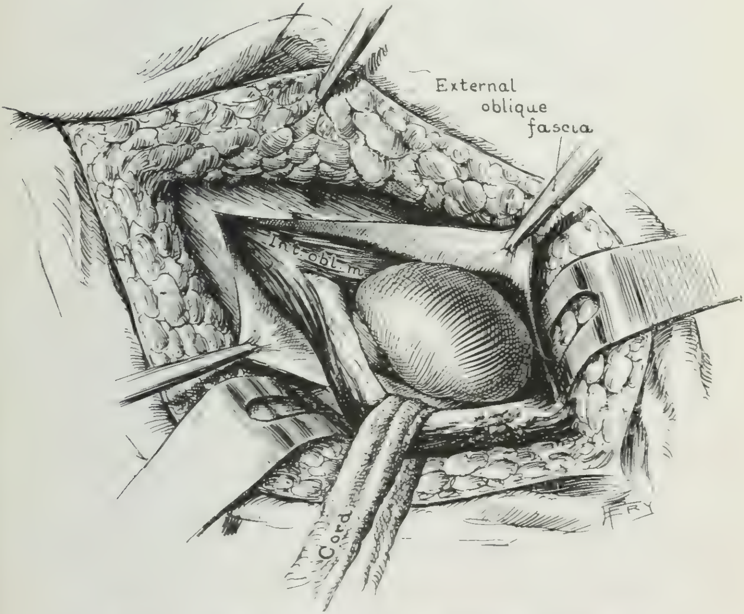
Spermatic cord freed through entire length of inguinal canal. Coverings of cord held with forceps.—Masson. (See p. 484.)

PLATE XXXV.



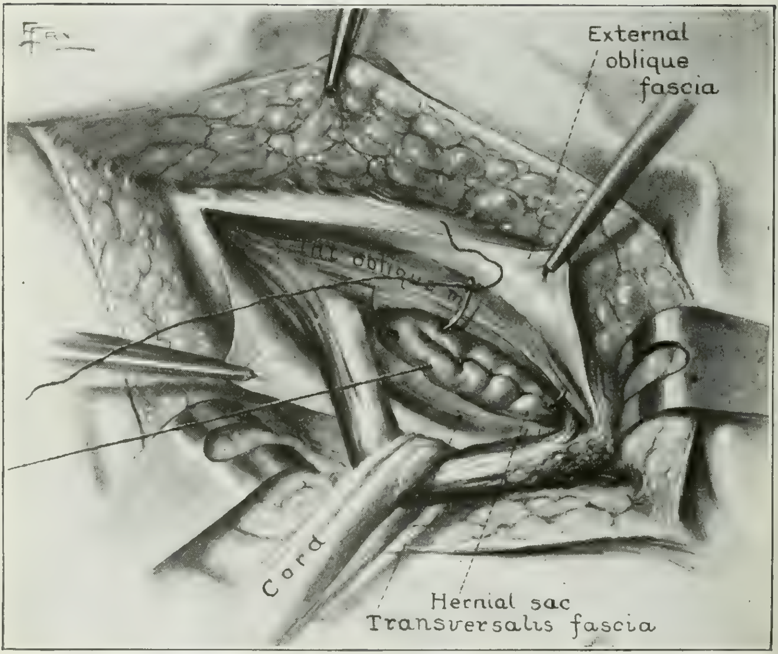
Same. *a*, Hernial sac isolated. Neck ligated and suture carried through internal oblique above internal ring.
b, Sac excised. Closure of cremaster preliminary to fixing neck of sac well above internal ring.—Masson. (See p. 484.)

PLATE XXXVI.



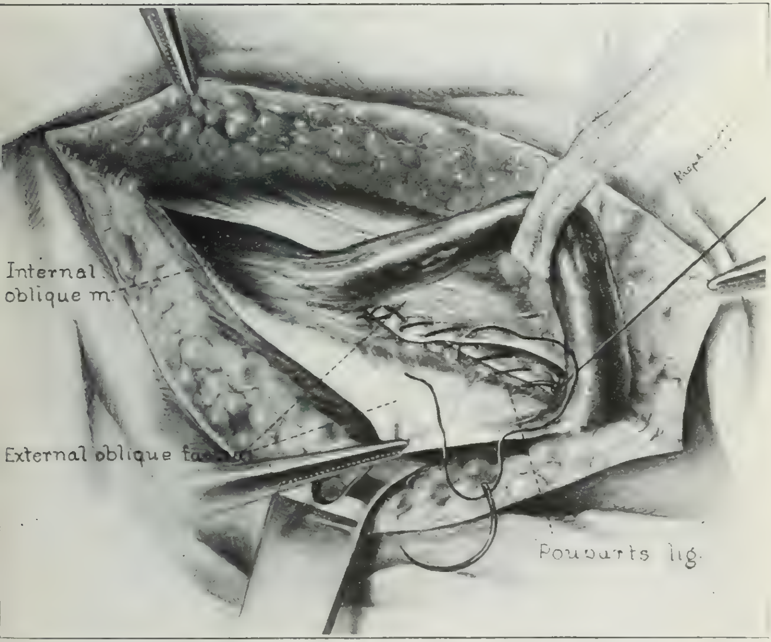
Same. Direct inguinal hernia.—Masson. (See p. 484.)

PLATE XXXVII.



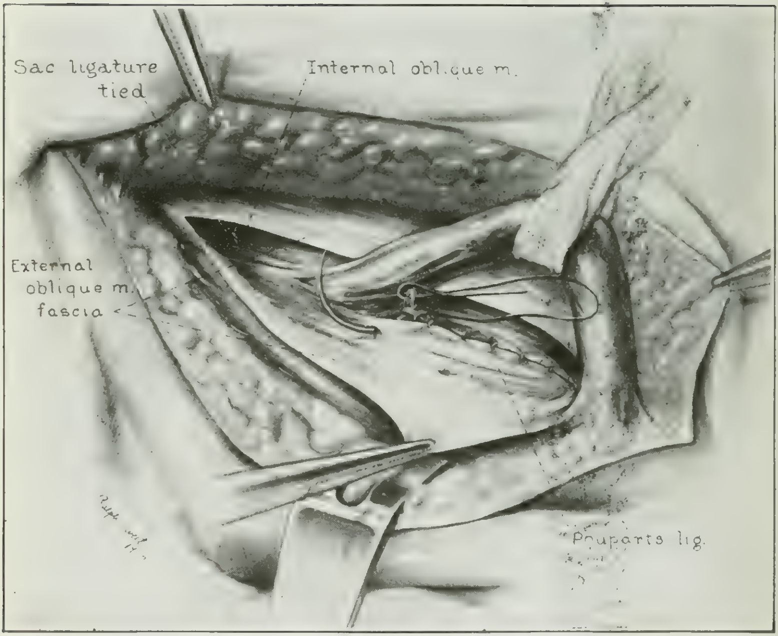
Same. Sac of direct hernia inverted without removing any of it, and the base with adherent preperitoneal fat sutured.—Masson. (See p. 484.)

PLATE XXXVIII.



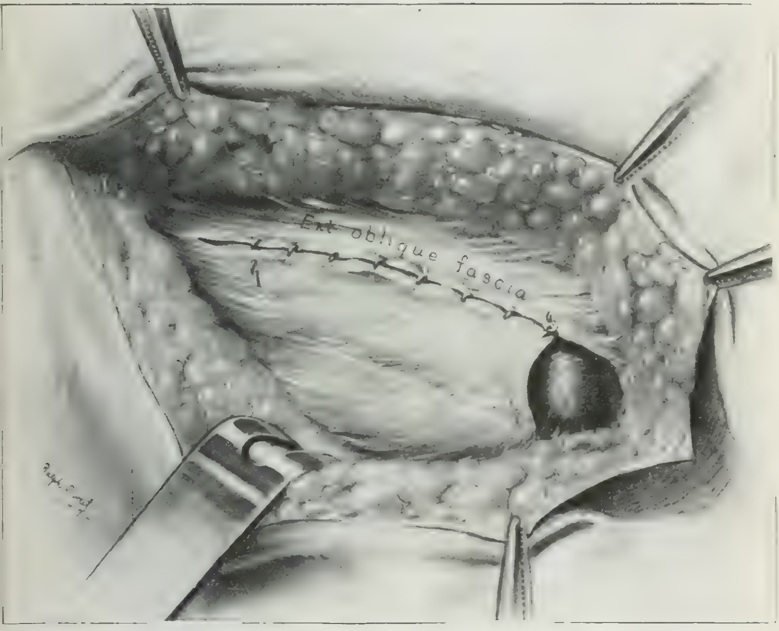
Same. Conjoined tendon and internal oblique sutured to Poupart's ligament with continuous chromic gut.—Masson. (See Fig. 484.)

PLATE XXXIX.



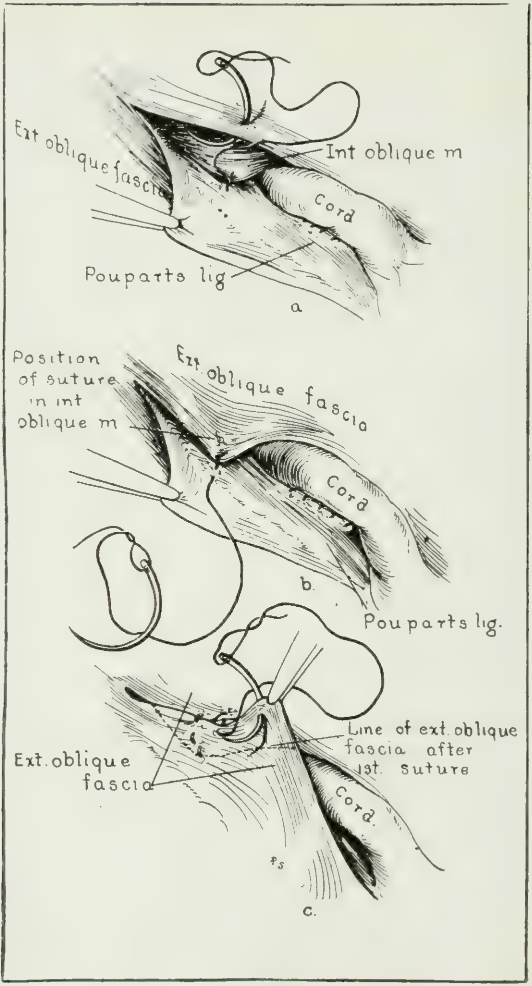
Same. Upper layer of external oblique sutured to Poupart's ligament.—Masson. (See p. 484.)

PLATE XL.



Same. Cord structures covered with the lower layer of external oblique aponeurosis.—Masson. (See p. 484.)

PLATE XLI.



Same. Internal and external oblique sutured to Poupart's ligament above the level of internal ring.—Masson. (See p. 484.)

varied from 23 to 77. This in itself throws an interesting sidelight on the possibilities in the aged.

Since every hernia offers the potential possibilities of becoming a grave danger, operative repair at an early date should always be advised. But if reduction by taxis is demanded all manipulations should be done with extreme gentleness. If unsuccessful, operative reduction rather than force, is by far the safer.

In a young man under the care of C. Bennett[2] *appendical pus in the sac simulated strangulated hernia.* R. inguinal hernia since childhood, reduced several times by taxis. The day prior was seized with pain in iliac region, and vomited. A few hours later his hernia, as he thought, became again irreducible because there was a very painful swelling in the scrotum which he could not put back. As on former occasions, therefore, he had to summon his doctor. Efforts to reduce the supposed hernia were unavailing, and patient sent into hospital. Bennett examined him shortly after arrival and found a tense, elastic, inguino-scrotal swelling, which was so tender that any handling was intolerable. T. 99.4° and P. about 96. When anesthetized he found the scrotal swelling irreducible, and detected distinct resistance in iliac fossa, suggestive of an abdominal abscess. It seemed best to open up the inguinal region first; when this was done Bennett discovered a hernia sac full of pus, which had the odor of *B. coli* infection. The neck was sealed by the inflammatory process, thus accounting for the irreducibility. The sac was ligated at the neck, after the adherent structures had been stripped off and excised. McBurney's method was next used for appendicitis, with excellent recovery.

W. Doolin[3] met with an *inflamed appendix in a hernial sac.* A woman, of 42, the day before had been suddenly seized with pain in groin; during the night vomiting set in, and was progressive. The bowels had acted in a. m. A small swelling—painful, tense, and very tender—presented in upper angle of Scarpa's triangle. No tenderness nor rigidity above the Poupart line. P. 88, and T. 100.2° F. Preoperative diagnosis "strangulated femoral

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(2) British Med. Jour., July 19, 1919.
(3) Ibid., Aug. 23, 1919.

hernia, probably of the Richter type.'' On opening the sac he was surprised to find lying within it a swollen appendix, distended with pus. The appendix was clamped and removed. The neck of sac was then divided, and Gimbernat's cautiously cut; through the enlarged ring the cecum gently coaxed down, and stump inverted with the usual pursestring. The canal was closed by interrupted sutures from Poupart's lig. to pectineal fascia. No drainage; uneventful recovery.

Unusual Forms. Within a comparatively short time 4 patients were operated upon by J. H. Pringle[4] on account of well-marked gastric symptoms, and in each practically all the small bowel had *herniated into and across the lesser sac of peritoneum.* The only portion not herniated was the last 6 to 8 in. of ileum which formed the emerging coil. In each the bowel had entered the lesser sac through that portion of the transverse mesocolon where it is usually divided when one makes a post. gastroenterostomy. In 2 females, aged 55 and 26, the bowel escaped from lesser sac into the peritoneal cavity again through the gastrohepatic omentum. While in a man, of 36, and a woman, of 35, it passed through the gastrocolic ligament.

He divides such herniæ into the lesser sac into 2 main types, viz.:—1. Hernia through the f. of Winslow, and 2. Hernia through an abnormal opening. This abnormal opening may be situated (*a*) in the mesocolon, where it would appear to be most frequently placed within the arch of the middle and left colic arteries, or (*b*) the opening may be in some part of omentum. If the bowel pass beneath the colic arch it may (*a*) remain in the lesser sac and present either above or below stomach, or (*b*) may escape again into the peritoneal cavity above the stomach (''gastrohepatic'') or below (''gastrocolic''). In most herniæ through the f. of Winslow recorded, a comparatively short length was herniated. The larger herniæ seem to have presented beneath the gastrohepatic omentum, and in one case (Treves) the cecum and appendix had burst through.

Hernia through the foramen of Winslow occurred in

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(4) Glasgow Med. Jour., March, 1919.

an adult male, operated on by J. E. Engstad.[5] While lifting a heavy object some 12 hours previous, there was a sudden attack of pain. He had to be brought over 20 miles in an auto, after speedy preparation, a strangulated portion of upper jejunum was found, and released with considerable difficulty. Convalescence delayed by intestinal fistula.

Fatty Hernias. K. Hale[6] had an opportunity to operate on *2 cases:* I. Woman, aged 70, after heavy lifting had pain in r. groin. Next day pain and vomiting, swelling size of small hen's egg in region of femoral hernia. The patient has always been constipated; never had any serious illness. Has had frequent pain starting in r. axillary line at costal margin and radiating down to inguinal region for 40 years. Incision revealed a tar-black mass projecting through saphenous opening and situated within a thin transparent sac which was supposed to be the peritoneal sac of a femoral hernia. Gimbernat's lig. was divided, when the appendix slipped out through the opening made in the true peritoneal sac at femoral ring. The strangulated mass was a fatty tumor surrounding the peritoneal sac. The radiating pain stopped, and constipation was relieved.

II. Woman also, small mass just above umbilicus. Found to be small lobule passing through l. alba.

Such hernias can be located in region of indirect inguinal hernia, in femoral region, l. alba or l. semilunaris. Are gradual in development but onset may follow a sudden exertion or injury and patient first notices tumor at that time. May or may not have a peritoneal sac. The latter is usually small and empty but can have contents of ordinary hernias. Fatty tumor can be on either the inside or outside of sac if latter is present. Can become strangulated with an empty sac or even without a sac, and with or without torsion. Impulse on coughing generally absent. False reduction possible. Diagnosis difficult. Treat as an ordinary hernia.

Diaphragmatic Hernia. Stress is laid by J. L. DeCourcy[7] on a few *symptoms* which he believes to char-

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(5) Jour. Amer. Med. Ass'n., Feb. 8, 1919.
(6) Annals of Surg., March, 1919.
(7) Ibid., August, 1919.

acterize non-traumatic cases: (*a*) Pain after eating has always been a more or less certain symptom of stomach ulcer, and the symptoms of diaphragmatic hernia frequently resemble ulcer (his own case was treated for ulcer for a year), but the farther the pain from the time of eating the more apt we are to be dealing with ulcer. Pain immediately after ingestion of food, with distress and a sense of fullness, is suggestive of hernia in which the stomach is herniated. (*b*) Paroxysms of smothering and difficulty in breathing attributable to no other cause. (*c*) Vomiting coming on without premonition.

The objective symptoms, *e. g.*, heart being pushed to r. and tympanites over the area where the heart originally lay, together with the subjective symptoms, should at least suggest hernia. *X*-ray should not be considered as conclusive in the face of negative findings.

Two diaphragmatic hernias *following war wounds* were narrated at the Paris Surgical Society:[8]

I. After a thoracoabdominal wound, the splenic flexure passed through the gap, and appeared under the scarred skin. It was very adherent, and the only way it could be freed, was by dividing it at its entrance and exit, and making end-to-end union. This was done successfully by M. Michon.

II. In the one operated on by G. Cotte, there was another thoracoabdominal wound, from a bullet with escape of stomach, transverse colon, omentum, and spleen, into thorax. An incision was made from 6th l. space for 9.6 in. giving free access, all the adherent organs were extricated save the spleen, while being freed, this was torn and bled so splenectomy was done. The gap in diaphragm was 6 in. long, and was sutured. Healing delayed by pyothorax.

A third case was operated on by Lake and Kevin.[9] A war-prisoner, aged 20, was wounded in l. chest, Sept. 27, admitted Oct. 5. Pain and constipation, Dec. 11. Next a. m., collapsed. Provisional diagnosis obstruction, probably due to band in splenic region. Anesthetization very difficult owing to the rapidly increasing dyspnea. Abdomen opened in midline as rapidly as possible with

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(8) Presse Méd., July 31, 1919.
(9) Lancet, July 5, 1919.

a view to relieving this. The distended intestines were allowed to come out of the wound. No relief to respiratory embarrassment. The transverse colon was enormously distended; the obstruction obviously lay somewhere in the region of the splenic flexure which could be felt drawn up under l. dome of diaphragm.

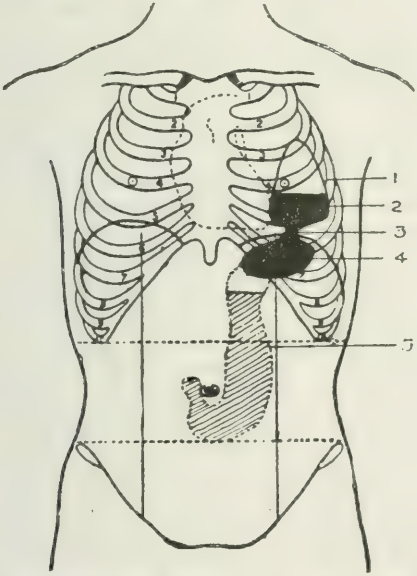

Fig. 151. Diaphragmatic hernia. 1, cardia filled with air; 2, upper level of opaque meal; 3, diaphragm; 4, pylorus still in abdomen; 5, position of normal stomach (Andrew).

At this point respiration ceased; all the usual means were employed with no response. Necropsy showed an aperture in diaphragm, a considerable coil of splenic flexure had passed through opening. Strangulation at the sharp edge of aperture. The bowel occupied practically the whole l. side of thorax; lung was compressed to a small mass and heart displaced well to r.

The case of *hernia of omentum and nearly the entire stomach,* related by J. G. Andrew[1] is a glaring in-

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(1) British Med. Jour., Sept. 27, 1919.

stance of slipshod methods. The soldier was wounded March 12, 1917, and for nearly 2 years received nothing but medical treatment for "gastritis"! Unable to digest the army rations he was accused of malingering, etc.

Finally on Feb. 19, 1919, having been dismissed from hospital he came under Andrew's care, and the first *x*-ray was taken, showing most of stomach above diaphragm. At operation with considerable difficulty the stomach was drawn back into abdomen. The omentum had contracted adhesion to everything it came into contact with, and probably to the lung. Any traction caused hemorrhage, and a portion so adherent it was dangerous to remove was left in cavity. The diaphragm was closed by strong silk. The stomach appeared thickened as if hypertrophied in the vain effort to pass the food on, but more striking was the absence so far as one could see of any track by the bullet. Primary healing.

At the London Hospital, *4 cases* were admitted in 10 years, and R. Warren[2] bases his remarks on these, and 4 personal ones: The age varied from 16-68. Injury plays an important part. Four cases were the result of gunshot wounds and the chest and abdomen, a fifth had suffered from fractured ribs on both sides in a buffer accident. Two were 16 and 30—with no history of injury, and probably due to congenital defects; the last case was a female of 68 with a long history of wasting and vomiting, no injury, and so may also have been of congenital origin. In five cases the opening was in front of the esophageal opening: in one was an enlarged esophageal opening, in 2 position is not mentioned.

In 4 cases the contents of the hernia were stomach, in 2 large gut, in 2 small gut.

In 6 cases there were acute obstruction and strangulation, in 1 case subacute obstruction of a recurrent type, in 1 case no obstruction but an associated pyloric ulcer, laparotomy for which led to discovery of the more rare condition. The last case, war-wound, reached base moribund, and died in 4 hours. Of the 7 operations, but one was successful, another war-wound nearly 3 years old.

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(2) Lancet, June 21, 1919.

THE LIVER.

Technic. In a resection of the liver for carcinoma, L. Freeman[3] *controlled hemorrhage* by tying off the part to be removed by 2 long narrow strips of fascia lata, like pieces of tape. These strips were first pulled directly through the liver, from behind forwards, with long alligator forceps, and their respective ends tied very tightly around the hepatic substance to either side, much as one would tie off an ovarian tumor. (The presence of the fascia soon checks any bleeding from sides of the hole through which it is pulled, provided opening is not too large: hence the importance of alligator forceps, or at least those which are long and narrow.) In a similar case years ago, he used gauze tape: but the difficulty experienced in the subsequent extraction dissuaded him from using again, in spite of its otherwise admirable efficiency. F. lata can be left in place without fear of trouble later on. It is just as easily handled and just as effective as tape, will not stretch and will withstand much force in tying.

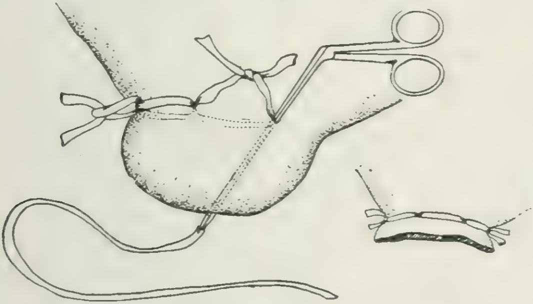

Fig. 152. Hemostasis of liver (Freeman).

Successful *operation for laceration* was done by J. B. Roberts.[4] A girl, of 8, was knocked over by an auto. On admission there was great pain in upper abdomen, and percussion showed fluid. He found a tongue-shaped flap about 2½ in. long and 1½ wide had been torn off from the lower surface near gallbladder. The pedicle

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(3) Colorado Med., May, 1919.
(4) Annals of Surg., August, 1919.

was posterior. There was blood in abdomen, retroperitoneal space and in the gastrohepatic omentum. By turning the flap up and pressing a thumb upon it, it was held and checked. He put against the replaced tissue a packing of two yards of bandage 1½ in. wide. This was held in place by an old-fashioned glass drainage tube with its bell-shaped outer end against the packing and the end of tube brought obliquely through abdominal wall. The packing was gradually removed in 3 weeks. The fortunate result was due to getting the torn piece replaced before much bleeding had occurred. He reported some years ago a case in which he lost a patient after traumatic rupture of one of the hepatic veins upon which he had operated.

In the discussion, G. G. Ross said he had seen 2 ruptures, both of r. lobe, and treated by packing, without suture. The first case recovered after a stormy convalescence. In the second after the rent had been successfully packed it was reported a piece of gauze was missing. To account for this it was necessary to search the abdominal cavity and in so doing the gauze which had been packed into the liver was displaced and the man bled to death on table. In rupture with excessive hemorrhage and shock, a minimum amount of surgery is all that should be attempted.

Abscess. P. Talbot[5] analyzes the *symptoms and treatment* of hepatic abscess based on 15 cases (Mesopotamia). To diagnose the first one seen is not easy, there were 7 outstanding diagnostic signs present:

1. General enlargement of the liver	15
2. Pyrexia continuous or remittent	15
3. Leucocytosis	14*
4. A local tender spot over the liver	14
5. Signs of irritation at base of right lung	13
6. Rapid wasting	14
7. Heavy sweats	12

The other signs and symptoms of value are:

Local bulging	9
Pallor	12
Rigors	6
Referred pain in right shoulder	8
Rigidity of right rectus.	

* One not examined.

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(5) Lancet, Sept. 20, 1919.

Four early cases were treated by open operation and drainage by tube. Two were drained through incisions in the epigastrium, the exposed liver being packed round with gauze and the abscess opened by sinus forceps. In both the *Entameba histolytica* was found in the discharge from the tube on 3d day, although not found in the pus removed at the operation; evidently the organism was liberated during the breaking down of the abscess wall. The other 2 were treated by drainage through chest wall. After localizing by a glass syringe (20 c.c.) and needle, the needle was left *in situ* and 2½ in. of 10th rib excised in axillary line. The diaphragm was incised below the level of pleura, the edges sutured to the intercostal muscles. After packing gauze round the liver exposed a sinus forceps was passed into the abscess guided by needle. A tube was then passed in and sutured to chest wall. One died suddenly during the night following. The remaining 11 were all treated by aspiration with an ordinary 20 c.c. glass syringe and needle with a fairly large bore, which was passed in various directions until the abscess was found. Talbot found the syringe to be more convenient than the aspirator, and the needle, smaller diameter, probably did less damage. When the pus was found, as much as could readily be obtained was withdrawn, the syringe being detached, emptied, and used again as long as any pus could be evacuated.

After aspiration every patient was given hypodermic injections of emetin hydrochlorid, 1 grain daily for one week and then on alternate days until 12 or 14 grains had been given. Whenever possible each patient was given 1 grain a few hours before operation, so the first serum to flush the abscess should be carrying emetin. The action in these cases appears to be as specific as quinin in malaria.

There were multiple abscesses in 3 cases. The average quantity of pus was 8½ oz. The greatest quantity in any case was 30 oz. In color the pus was yellow in 11 cases and grey in 3. The classic chocolate pus was seen in one case only; the yellow pus rapidly became much darker when exposed to the air. The pus was sterile in 8 cases, to contain *E. histolytica* in 3, staphylococcus in 3, and *B. coli* and *B. pyocyaneus* 1 each.

Fourteen cases recovered completely. One died as described. The majority of these cases can be treated successfully by aspiration with an ordinary 20 c.c. glass serum syringe. It does not appear to be necessary even to withdraw all the pus. Once the tension is relieved, the emetin-carrying plasma can pass through the walls of the cavity and exert its lethal effect on the amebæ there. After aspiration T. usually drops to normal at once, the liver rapidly diminishes in size, and convalescence is rapid. Open operation with a tube in the liver substance—one end in a constantly moving delicate organ and the other in the more or less rigid chest wall—would seem to be physiologically unsound.

Cirrhosis. A series of *23 omentopexies* for cirrhosis has been studied by Eliot and Colp.[6] There were 8 postoperative deaths, seven occurring within the first 8 days and one on 17th day. Of these deaths, six were due to a combination of cholemia and uremia; one to a cardiac failure, and one to mesenteric thrombosis.

In 7 cases under observation from three months to three years after operation, definite benefit has been derived. Of the 8 fatal cases, 1 died at four, 1 at three, and 1 at nine months respectively, with no benefit. Five cases left as improved, but all trace was lost. Of the 7 recoveries, ventral hernia was the sole complication.

In regard to the prognosis, probably the most favorable cases are those between the second and fourth decade, fairly well nourished, without severe nephritis, without cardiac lesions, without signs of compensatory circulation, which have stood a few tappings (not over 5), in which the disease has come on gradually—the symptoms extending over a year—where the liver was of the hypertrophic variety, and for which the Schiassi omentopexy was performed, without drainage, preferably under local anesthesia. That the operation is of benefit in carefully selected cases, there can be no doubt.

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(6) Surg., Gynecol. and Obstet., March, 1919.

THE GALLBLADDER AND BILE-DUCTS.

Technic. For *exposure in gallbladder surgery,* J. C. Masson[7] recommends a method, which helps in the more difficult cases to visualize the neck of gallbladder, the cystic d. and artery, and also their relations.

The abdominal incision extends from the midline at tip of ensiform to about 2 in. external to umbilicus. If necessary to remove the appendix incision may be extended down, especially if there is an excessive amount of subcutaneous tissue. When not contraindicated the usual exploration is made. The stomach, large bowel, omentum and small intestine, are separated by 3 or 4 abdominal sponges, held by l. hand of assistant. It is important when once the sponges are in place that the assistant should not move this hand during operation. In almost all such cases this exposure is all that is needed, even when the r. lobe of liver cannot be rotated. In the exceptional case, however, additional exposure is obtained by inserting a pack (4 in. by 36) between the posterior-superior surface of the right lobe and the diaphragm. In this manner the liver is made to descend slightly, the concave visceral surface is flattened somewhat, and the hilum made more accessible. The insertion is easy and if carefully placed it can in no way injure either liver or diaphragm. With an ordinary abdominal retractor the second assistant retracts the right costal margin up and out, while with a long shoe-horn retractor the first assistant gently retracts the liver in the opposite direction. The operator is now able to place the pack by a 9-inch tissue forceps, carrying the gauze along the shoe-horn retractor. (Plates XLII, XLIII).

Injuries to the hepatic or common d., or hemorrhage, are always avoidable if the operator can see what he is doing and proceeds carefully. As anomalies of both ducts and blood-vessels are very common, absolute knowledge of what is in each forceps before it is clamped is necessary to safety. In large, tense gallbladders it is often advisable first to empty with a trocar, and then to apply a 6-inch curved forceps to the fundus and another

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(7) Annals of Surg., April, 1919.

to the ampulla where it overlies the common d. By drawing on the forceps, especially the last one, the cystic d. is stretched, and by a little blunt dissection with a pair of 7-inch curved forceps, it may be isolated and exposed throughout its entire length. Before cutting this duct the common d. should be palpated; it is much easier to do this now than later, as it can be steadied by traction on the forceps attached to the ampulla. The cystic d. and the artery are secured separately and ligated with plain catgut; care is taken to occlude the duct close to its juncture with the common d. and not to leave a pouch to be a possible cause of future trouble. If the common d. warrants exploration it is preferable to make the incision sufficiently long rather than attempt investigation through the open end of the cystic d., which is frequently very unsatisfactory. With the exposure outlined, all these procedures may be safely and quickly executed.

The technic of gallbladder and common duct surgery is taken up by H. M. Richter:[8]

Enucleation of the gallbladder. Most writers seem agreed the cystic d. should be isolated before division to insure the safety of the common d. But, as in recent years, a larger proportion of acutely distended gallbladders are removed rather than drained, it is frequently found the cystic d. is not easily reached without preliminary emptying of the gallbladder. Particularly is this true where the preliminary rotation of the liver is not readily or perfectly accomplished. The tense gallbladder pushes the cystic d. back and up, away from the operator, since the fundus is fixed to the liver and the apex must, therefore, be the most disturbed part. A tense gallbladder will lift itself out of the incision into the hand if it is first released from the liver. This is accomplished by splitting the peritoneum as it is reflected from the liver on to the gallbladder, just enough to admit a finger. The finger is inserted and the bladder peeled out of its bed. In this way the cystic d. is mobilized and made easily accessible. It is a fact that peeling out in the opposite direction—from the apex toward the fundus—is somewhat cleaner, since the vessels are caught before their branches are torn; but this is a

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(8) Surg., Gynecol. and Obstet., November, 1919.

matter of but a moment's time, and the loss of blood will usually be trifling if the plane of cleavage is not lost.

The cystic duct. This should rarely be clamped with its vessels, tissues, and peritoneum *in toto.* It is much cleaner to break or split the overlying peritoneum and clamp it after having isolated it. It is quite unnecessary to ligate it close to the common d.; one must avoid the careless ligature of the apex of the gallbladder itself, lest a continued infection of the stub remain, a danger to which C. H. Mayo and others have called attention. Many insist upon severing the cystic d. close to its termination. Their suggestion is based mainly upon the well-known fact that the stump tends to enlarge after removal of the gallbladder. But the cystic is probably as rarely the site of origin of stones as are the other ducts. Stones have been left behind but that should be charged to careless technic.

The flaps of peritoneum. In peeling out the finger naturally finds the plane of cleavage and with little care the liver is not torn; on each side part of the peritoneum is peeled off to be left behind to cover in the denuded liver. But these flaps are of minor importance, and *should not be sutured over the denuded liver,* merely pressed against it. In this way they will adhere as a Thiersch graft.

The raw surface. The denuded surface is partly covered, but this step is of slight importance. The surface is depressed and not exposed to contact with adjacent structures; the gauze pack is a much more potent cause of adhesion. A satisfactory method of minimizing adhesions is to drop the omentum in between liver and duodenum. It is rather the oozing from this surface that may be important, and possibly to some extent, the leakage of bile from the torn surface. Oozing may be sufficient to make closure unsafe, though this is exceptional. Bile leakage may be a factor in an otherwise unaccountable postoperative reaction.

Cholecystitis. The frequency of *"strawberry" gallbladders* is set forth by W. C. MacCarty.[1] Several years ago, studying a series of 365 which had been removed in

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(1) Annals of Surg., February, 1919.

the Mayo Clinic, he grouped the various stages of cholecystitis as follows:

I: Cholecystitis Catarrhalis Acuta. Gallbladders "normal," except the villi, congested and infiltrated with lymphocytes, are more prominent. The infiltration may extend into the other layers of the wall, occurs with or without stones.

II: C. Catarrhalis Chronica. Varies from I only in degree, and one portion may belong to the first and another portion to this group. The principal change grossly consists in an "erosion" of the villi. Their desquamated apices present as yellow specks scattered over the mucosa. Otherwise the mucosa may appear normal or congested. This condition he described as the "strawberry" gallbladder from resemblance of the specks to strawberry seeds. Microscopically, the epithelium is lost and replaced by scar tissue. Clinically, nothing to distinguish this group from I., found with or without stones.

III: C. Catarrhalis Papillomatosa. Only 1 specimen. A villus was enlarged and appeared as a papilloma. Associated with stones and an acute catarrhal reaction.

IV: C. Papillomatosa Malignum. Like other papillomata, these often undergo an irregular hyperplasia, which manifests itself in marked reduplication of the rows of epithelial cells. This type does not occur in this series because the cases seen were studied at exploration of inoperable cases.

V: C. Catarrhalis Carcinomatosa. The neoplastic condition in the least advanced portions appears as knoblike outgrowths covered by epithelium in a stage of malignant hyperplasia, which differs apparently from simple hyperplasia morphologically in that the cells are irregular, undifferentiated and show invasive growth. There are areas, however, which contain glands, the nuclei of which are regular and indistinguishable from normal or hyperplastic glands. The more extensive outgrowths arise from the mucosa and possess a base not unlike that in the papilloma. Differentiation between this and Group IV, must be made with reserve, because it is possible the one is but a stage of the other. No specimens in MacCarty's series presented sufficient evidence for grouping both conditions under one heading. They present papillomatous outgrowths, differing only in shape (V knobs, IV filiform and less massive).

VI: C. Chronica. In this group is a condition, gradual stages of which may be seen in II. The continued desquamation is associated with proliferation of the connective tissue. The surface contracts irregularly and leaves ridges of scar tissue. The process is not always complete over the whole bladder, as a result of which areas of I and II may be seen. It may occur at operation with or without stones. The mucosa has almost completely disappeared and the process is a chronic one involving the other coats.

VII: C. Chronica Cystica. A stone may become lodged in the cystic d. or in the neck of bladder and cause obstruction. This results in thinning of the wall and destruction of the mucosa or flattening of the ridges in chronic cases. The stone is usually firmly embedded between the valves and cannot be moved. A thin layer of connective tissue in which traces of the nuclei of muscle-cells may be seen sometimes. Such a gallbladder usually presents itself as a large palpable tumor.

VIII: C. Purulenta Necrotica. During any stage of inflammation obstruction to the cystic d. may be so great, or the infection so virulent, that disturbance of the circulation or multiple abscesses may occur. The specimens are usually distended, dark blue or black, the contents pus or blood and usually not bile-stained.

Pericholecystitis must be considered a sequel to any of the above-mentioned degrees. Even in the earliest degree of c. c. acuta the process may extend to the serosa through the lymphatics, and it is not infrequent to see adhesions in this stage.

Since this classification was made over 5000 bladders have been studied. The strawberry appearance was described as due to "erosions" of the apices of the villi. This is an error undoubtedly due to the fact that MacCarty studied fixed specimens which had probably been extensively handled before. The epithelium was undoubtedly eroded in some advanced cases, but that the great majority represent this condition is a mistake. The epithelium is intact and the appearance is due to a lipoid substance within the swollen connective-tissue cells just beneath. The villi may or may not be much larger than normal, although in many are several times normal size. The condition may be present in one, many, or all of the villi. The villi are occasionally so large and branched they form papillomas which may be single or multiple. Histologically such papillomas are identical with the villi of the "strawberry" gallbladder, being merely larger and branched. (Frontispiece.)

In 5000 gallbladders removed between Oct. 17, 1911, and Sept. 11, 1918, there were 936 (18 + %) "strawberry" and 198 (4%) papillomatous gallbladders. A most important fact is the increased and relative frequency with which this condition has been noted since cholecystectomy has become more common.

A woman, of 33, shown by W. Meyer[3] presented a rare *pathognomic symptom of cholecystitis.* She had had for years attacks of pain on l. side of upper abdomen corresponding to costal arch, and radiating down to l. of abdomen. Also to the back and l. shoulder, but never to right and never toward liver. He had seen patients with similar symptoms at his office, in whom he could not ascertain what the trouble was. He had thought of ulcer of lesser curvature, chronic pancreatitis, or a kidney lesion, but could not make the diagnosis; they refused hospital care and drifted away. This patient came with such a distinct record of attacks reminding of chronic cholecystitis. She was sent for laboratory examination. All the usual examinations were made, except of duodenal contents. While in the hospital she had pain for the first time that was radiated from left to right. The gallbladder, filled with stones, was found low beneath liver so it could not have been palpated.

The examination of the duodenal contents is a very welcome addition to our resources. The x-ray fails in many cases to give sufficient pathognomic signs. Meyer thinks the rays can make a positive diagnosis in only 15 or 20 per cent. Examination of the duodenal contents may show pus corpuscles, cholesterin, putrid bile, etc. During operation the gallbladder is aspirated and the color of the bile compared with that found in duodenal

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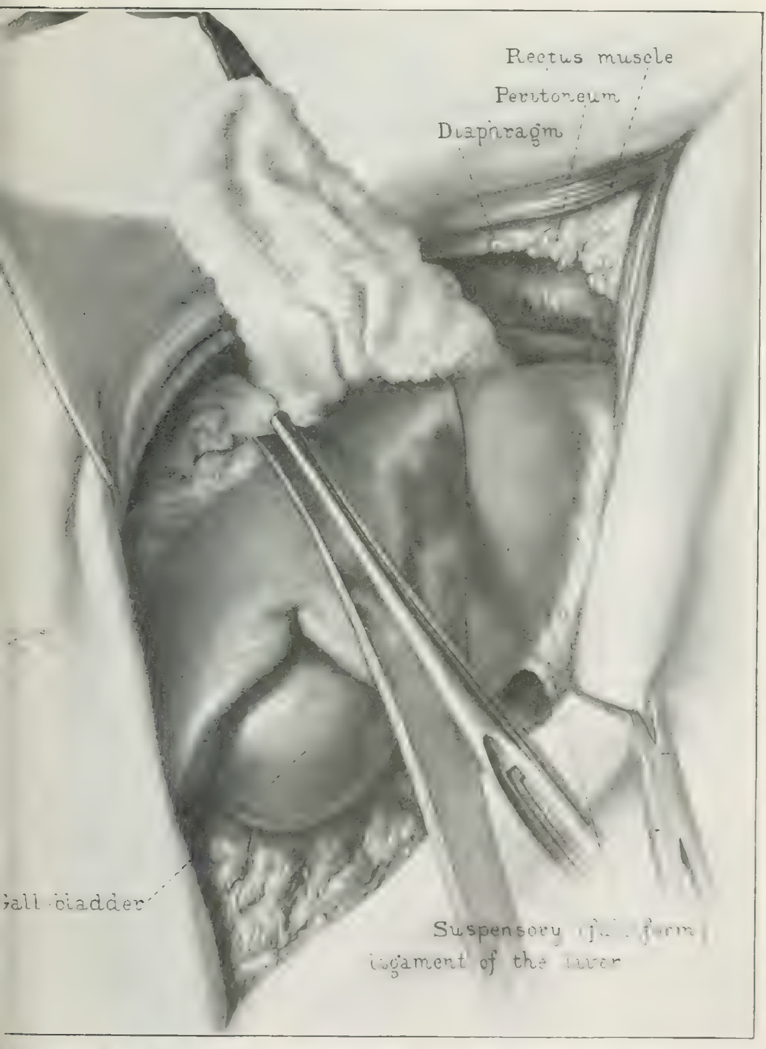
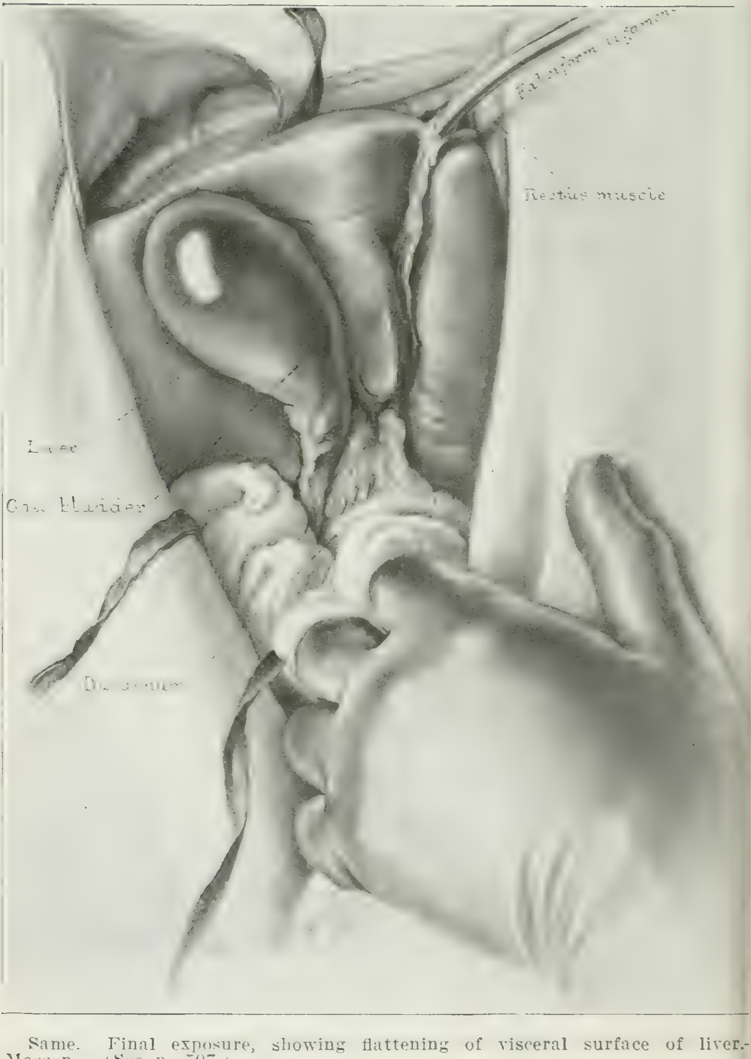
(3) Annals of Surg., June, 1919.

PLATE XLII.



Exposure of gallbladder. Inserting pack between liver and diaphragm.—asson. (See p. 507.)

PLATE XLIII.



Same. Final exposure, showing flattening of visceral surface of liver.—Masson. (See p. 507.)

contents. It almost invariably corresponds and hence the examination of the duodenal contents gives a good idea of the real condition of the bile. The particular point desired to be brought out was if a patient comes with paroxysmal pains in the extreme l. side and the same runs to the back and also to the l. shoulder, one has also to think of cholecystitis. Patients with cholangitis are always jaundiced, though sometimes but slightly, but those with cholecystitis are not; they are discharging their bile physiologically into the abdomen and if one examines the duodenal contents one can get points on the diagnosis that are of value.

R. H. Babcock[4] dwells on the diagnosis of chronic *cholecystitis complicating cardiac lesions.* Some digestive disorder in cardiopaths is very common. This might be pain, but more often it is eructations or flatulence, or possibly palpitation. It is not easy to determine whether the gastrointestinal symptoms are referable to the cardiac lesion indirectly or to conditions within abdomen.

For several years when a cardiopath complains of symptoms referable to the gastrointestinal rather than to the respiratory and circulatory systems, it was his habit to pay particular attention to the abdominal organs, and frequently he had recognized chronic disease of the gallbladder or appendix as responsible. The symptom most frequently complained was either an attack of what they called acute indigestion, with or without pain, commonly with some pain, and tenderness in epigastrium, or on one side, usually the right, or the patient gave a history of what he called ''chronic stomach trouble'' by which he meant that most of the time he was more or less distressed by what he ate. That a close connection might exist between any chronic indigestion, or even acute attacks of indigestion and a cardiac lesion, was readily admitted. But if on study one found the symptoms were referable to the digestive system rather than to the heart or to the lungs, suspicion at once attached to a disorder of gallbladder or appendix. The amount of systemic disturbance might be insignificant, *i. e.*, in the interim between attacks of acute cholecystitis or exacerbation of a chronic cholecystitis, the patient might have no

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(4) Bull. Chicago Med. Soc., Nov. 22, 1919.

temperature or so little rise as to escape his detection. During the acute crisis, however, he might have a very distinct febrile attack that would attract his attention, Nausea and vomiting had not been common in chronic cholecystitis any more than was icterus. There may be a subicteric hue, but distinct icterus required careful search for its detection.

His experience with operation of cases of cholecystitis in cardiopaths had convinced him it was ordinarily safe if done in the right manner by a gentle and rapid operator, and by one who tried to consider the case from the standpoint of the individual rather than of a perfect operation. There was a tendency to do as complete an operation as possible to rectify all the pathology present. In a cardiopath this was not ordinarily justifiable and the cases he had had operated on successfully had practically all recovered. A very prominent surgeon not only removed the gallbladder but did a very elaborate operation on the common d., also removed the appendix, doing a very beautiful job, but with what result? On the third day there was a collapse and on the fifth a fatal one. He could not help feeling that if the surgeon had not done such an elaborate operation the result might have been different. If a patient with a cardiac disease came complaining of palpitations which were not evoked by effort, which apparently had no reference to what the patient ate, if these came on in the small hours and woke him out of sleep, he was suspicious of something wrong in the abdomen, and sometimes it pointed to a diseased appendix or to involvement of the gallbladder. It was known that acute cholecystitis with icterus would produce bradycardia, but just why it produced a tachycardia, and especially an arrhythmia, and why it produced dilatation one could not always say.

In the discussion F. Smithies said in an analysis of 1000 examples of gallbladder disease (1918 volume, p. 507), he found in 37 there was an organic heart lesion; that in 56 instances there were cardiac arrhythmias: *i. e.*, in about 8 per cent. there were symptoms and signs referable to the heart. This was a considerable percentage, and certainly should be given attention by clinicians, diagnosticians and surgeons. More attention should be paid to the *x*-ray findings, particularly those from the fluoroscope. Furthermore, where there was some indication, some suspicion of disease in the biliary tract, frequently valuable information could be derived from a study of the freshly removed bile by the duodenal tube. This bile in many instances showed marked changes, either grossly, chemically or bacteriologically.

As an explanation of cardiac symptoms due to the gallbladder upset, it seemed they fell under several heads. In the first place, these symptoms occurred immediately following a meal, due to pyloric spasm as a result of gallbladder disease (Meltzer). There was frequently marked pylorospasm, hyperperistalsis, distension of stomach, etc. The next set of symptoms occurred at night. In the series of cases 69 per cent. exhibited stasis of marked or mild degree. Due to ordinary activity at night the large intestine was filled. It happened in individuals who were not ill. If it happened in an individual who was ill, there was filling with feces and gas of the cecum, the asc. colon, and there was scarcely room to accommodate the filled intestine, enlarged gallbladder and swollen liver. As a consequence, there was often pressure upon the diaphragm, secondary irritation and frequently marked nocturnal distress. Much of the precordial pain in young individuals in the subacute cases could be ascribed to pronounced spasm at the cardia. He had seen a number of instances where there had been such spasm. Upon taking food one could detect fluoroscopically and symptomatically the disturbance of which the patient complained. Furthermore, the heart appeared to be embarrassed as a result of continuous infection. In his experience the mitral valve was usually at fault. He had had a few where the aortic valve was involved. It meant if there was an actively infected gallbladder, there was the possibility of a continuance of infection as a result of the organisms getting into the blood either constantly or periodically. It was possible for endocarditis to light up at irregular intervals.

Cholelithiasis. A. M. Willis[5] reviews his experience

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(5) Jour. Amer. Med. Ass'n., May 10, 1919.

with *stone in the common duct*, 50 cases, about 10% of the total operations. He concludes a certain number of patients with stone in common d. do not present symptoms sufficiently suggestive to justify exploration of duct, and in some of these, palpation will fail to disclose the stone. Even exploration sometimes fails to reveal calculi, though the previous and subsequent history of these patients may indicate or prove stones were actually present.

The mortality in cases subjected to operation is variously given at from 6 to 16%. In his series, 5 died. In the gallbladder cases, exclusive of calculi in common d., the mortality was about 2. The obvious lesson is in cholelithiasis operation should be performed early before the entrance or formation of the calculus in common d., and we are again reminded that medical temporizing is fraught with peril.

In 2 patients with *gastrospasm located in the prepyloric region* M. Lüdin[6] performed cholecystectomy and relieved the condition; the biliary calculi had not been diagnosed. He remarks diagnosis is often difficult between such spasmodic condition and regional carcinoma, nor does the *x*-ray always decide. Antispasmodics as well may fail, and only exploratory operation, as in his cases, will clear up the confusion.

End-Results of Operations. *Recurrence of symptoms* following operations is believed by J. H. Jacobson[7] to be more frequent than is generally supposed. After cholecystotomy it occurs from retention of infected contents, rather than from leaving stones behind at the primary operation. Routine operations should be made more thorough and complete by adequate incisions, cholecystectomy, and accurate exploration of the ducts. When the common d. shows marked dilatation it should be opened and explored and special attention should be given to its terminal portion for the detection of calculi and constrictions. The detached gallbladder from its bed on the liver, acts as an efficient tractor, and greatly aids in making the exploration of ducts complete.

Experience in *204 operations for gallbladder disease*

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(6) Corr.-Bl. f. Schw. Aerzte, Sept. 18, 1919.
(7) Amer. Jour. Obstet., January, 1919.

is contributed by W. B. Holden.[8] Only 41 were in males. In 166 calculi were found, in 29 cholecystitis without stones; the remainder were carcinoma and adhesions. Cholecystostomy was done 107 times, and cholecystectomy, 93. The number of stones varied from 1 to 318, 18 were in common d.

In 44 other operative procedures in abdomen, exclusive of removal of the appendix, were done at the same time. In recent years, unless there is some special counterindication, the appendix is generally removed when gallbladder is operated upon. Hysterectomy was done 9 times in these cases; the tubes, one or both, 6 times; and hernia, 5 times. In some the gallbladder was the principal operation, and in others it was secondary. Except a death from cancer, there were no fatalities in any case where the disease and operative procedures were confined to the gallbladder. There were 3 in which the gallbladder and pelvic operations were combined. Five deaths were in cases deeply jaundiced—stones in common d. We might conclude that either cholecystostomy or cholecystectomy when the disease is confined to the gallbladder, are very safe. Jaundice and common d. stones greatly increase the risk, and major operations on pelvis should not be done at the same time.

The *end-results of gallbladder surgery* are analyzed by L. G. Bowers.[9] A questionnaire was sent to all patients operated on during 6 years, and 196 replied:

Out of 69 cholecystotomies, 33 reported themselves entirely well; 12 required a secondary operation and cholecystectomy was done with recovery, most of the 12 suggested the latter operation should have been done at first they felt so much better. Nine reported themselves improved, but had some tenderness and pain at intervals. Eight were the same or worse than before, and 7 died in hospital. The average in hospital was 22.1 days and for complete recovery 10 weeks.

In 127 cholecystectomies, 103 reported entirely well. Two required a second operation, no reason stated. Improved 6, and reported some improvement but had tenderness occasionally and some stomach distress, 10. In

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(8) Northwest Med., April, 1919.
(9) Ohio State Med. Jour., November, 1919.

a few of this last class a second letter indicated probably adhesions accounted for the trouble. They had been able to follow their vocations. Six died. The average in hospital was 16.6 days and complete recovery 7 weeks.

The double mortality for the cholecystotomies is not a fair conclusion, as most of the cases were acute. Such analysis could not be attributed to the mortality in the cholecystectomies. The end-results show a higher mortality in the cholecystotomies even after discounting the severe type of cases operated. Again the stay in the hospital for the cholecystotomies was 5.5 days longer. The reported time for complete recovery for the cholecystectomies was 3 weeks less.

All cases had been operated on over a year.

Cholecystectomy. W. H. Magie[1] asks *are we justified in removing a comparatively healthy gallbladder?* It is generally conceded that cholecystectomy has much greater mortality than cholecystostomy. If so, then this consideration also should bear weight in making up our decision. In 300 operations, he had no mortality in cholecystostomies, while that of cholecystectomy has been about the average, if not greater.

What are the indications for cholecystostomy? In his experience acute cholecystitis in all cases of only a few days' duration; also acute cholecystitis in some where there have been previous attacks, provided the walls are not much thickened and are free from adhesions that indicate previous serious attacks, provided, also, the cystic d. is open and the bladder contains bile. Many acute gallbladders contain but little bile at operation, due to swelling of cystic d., but within a day or two after sufficient time has elapsed for swelling to have been reduced, the bile escapes freely through the tube. All cases of simple cholelithiasis, when the exploration shows a comparatively healthy mucosa, are cases for cholecystostomy.

When should cholecystectomy be resorted to? *A.* in all cases of hydrops with stricture of cystic d.; *B.* in many cases of acute- or threatened gangrene, of the

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(1) Journal-Lancet, April 15, 1919.

gallbladder; *C.*, in all cases complicated with imbedded stones in the cystic d. with ulceration produced by contact with the stone which, when healed, would probably cause stricture; *D.* in all very thick walled gallbladders due to fibrous or calcareous degeneration; *E.* in all cases of ulceration due to pressure of large stones; *F.* in cancer where limited to the gallbladder.

The question of *what constitutes a good result in gallbladder surgery* is dwelt on by B. B. Davis.[2] He believes the most frequent causes of incomplete relief are: (1) impediments, as the result of strictures, torsions, and lessened elasticity of the common or hepatic d. to the free passage of the bile; (2) lack of contractility of the gallbladder wall, resulting in stagnation and continuous infection and a tendency for reinfections; (3) adhesions; (4) stricture or kink of cystic d.

The question was often asked, why do adhesions sometimes cause such great distress and sometimes apparently none at all? It has been found they occasionally produce a kink in the cystic or common d.; sometimes cause a kink at pylorus, which impedes the normal emptying of stomach; and at times the great omentum is caused to pull on the greater curvature enough to render peristalsis painful. All of these are sometimes found, but constitute only a small proportion of the symptoms producing postoperative adhesions. Davis early noted that many cholecystectomies produced more complete relief than cholecystostomies. He has been gradually led to the conclusion that a large part of postoperative distress is due to adhesions, and if we could avoid these, it would be greatly lessened. Efforts at more careful handling were redoubled, but with only slight improvement. The only effective way to avoid pericholecystic adhesions is to remove the gallbladder; and this is the most potent argument in favor of indiscriminate cholecystectomies. Surgeons have been compelled to resort to this because of the very unsatisfactory results following the more conservative operation. If any effective means could be found for preventing postoperative adhesions most of the gallbladder now removed could be profitably retained.

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(2) Journal-Lancet, April 15, 1919.

Removal of an organ of as much consequence is not ideal surgery. Even though a small mimic bladder forms after the real viscus has been removed, it cannot perform its functions as well. But for the present, at least, so frequent are postoperative symptoms because of adhesions that cholecystostomy should rarely be done. Even if such an ideal should be gained, there will still remain a comparatively large percentage so crippled they will have to be sacrificed.

In the discussion on the papers of Magie and Davis, A. J. Ochsner said at the time he had 2 patients whose gallbladders have been removed. He had quite a number of these cases whose gallbladders have been removed by the best of surgeons. It seems that every Swede or Pole who has trouble after the removal of his gallbladder goes to Augustana Hospital or St. Mary's. They come back complaining of exactly the same symptoms they had before operation, only they are coming about three times as fast as the patients who have had their gallstones removed and their gallbladders left in.

Stanton followed a lot of Ochsner's cases, and found that many of the patients in whom a drainage-tube was used after the removal of the gallstones had to be operated on again. He found that when the gallbladder was packed with gauze and sutured to the peritoneum and transversalis fascia the patient remained well; and did not require a secondary operation.

At Ochsner's clinic he sometimes has 3 gallbladder patients in one morning, and of that number may remove the gallbladder in one. Sometimes he may remove the gallbladders in all three. If reasonably sure there is something wrong about the cystic duct, or that the mucous lining will not recover as a result of tamponing with gauze, he takes out the gallbladder. If he cannot find an excuse for removing the gallbladder, after taking out the gallstones, he always re-examines by passing finger up from the common duct over the gallbladder, and when there is not a good excuse for removing such a bladder he leaves it attached to the peritoneum and transversalis fascia, tampons it with gauze, and later pulls out the gauze and lets the case alone. Since he quit using drainage tubes very few come back with trouble, but it was very different when drained with tubes. In that week he saw three patients who came back in trouble after cholecystectomy performed by excellent surgeons.

E. S. Judd observed we all agree that if there is definite pathology, if the gallbladder is diseased, it should be removed; but the point that comes up is whether or not there is anything wrong. It was formerly supposed that the infection came through the portal circulation down through the bile, and that stones were formed from the infection. The more recent view is the infection is carried through the blood and, when it involves the gallbladder, it is a gallbladder-tissue infection. If there is infection the gallbladder should be removed. Removal of the healthy organ is contraindicated, but, in all probability, there are many bladders that do not appear to be infected when they really are. We undoubtedly have two separate conditions to deal with, cholecystitis with stones and cholecystitis without stones. If the disease in the gallbladder is to be cured that organ must be removed. If the infection is in the bile-stream drainage may remove the stones, and cure.

A. S. Lobingier[3] enumerates the *contraindications to cholecystectomy:* One is in simple cholecystitis with or without stone, where the mucosa of the gallbladder and cystic d. is substantially normal. Another is in cholemia from impacted stone in common d. He years ago urged this condition should be relieved by a 2-stage operation—drainage of gallbladder to relieve the cholemia and reduce the swelling in the choledochus and later removal of stone. If the latter has been in a long time a stricture is a possible sequel. Cholecystectomy is obviously not to be thought of. Again, in obstruction at the ampulla, causing the bile to back up into the pancreatic d., drainage of gallbladder, instead of its removal, is plainly indicated. Finally, in septic cholangitis, where drainage is the cardinal principle, cholecystostomy is clearly the choice and cholecys-

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(3) California State Jour. Med., November, 1919.

tectomy, even if eventually necessary, must be done after the septic phase has completely passed.

PANCREATITIS.

Infection *transmitted by the lymphatics* from the gallbladder is believed by J. B. Deaver[4] to be the cause. The gallbladder, bile ducts, pyloric region and 2d part of duodenum, through their efferent lymph channels, are placed in intimate relation to the head of pancreas, and the head is most frequently involved in pancreatitis associated with other upper abdominal diseases. The course of infection has time and again been observed at the operating table in gallbladder disease. Inflammation of the gallbladder is followed by enlargement of the cystic lymph glands, periductal lymphangitis, enlargement of the glands at the head and the margin of the pancreas and often of the regional lymph channels at the head of the pancreas. Induration of the head of the pancreas about the common duct is present in 35 to 40% of disease of the gallbladder. The first stage of chronic pancreatitis is nearly always disease of the pancreatic lymph glands.

Archibald and Brow[5] have investigated the experimental production of pancreatitis as a result of the *resistance of the common duct sphincter.* The former analyzing some 50 cases of pancreatitis found in over 50% operation demonstrated the absence of either stones or cholecystitis. The conclusion imposed itself there must exist some other cause of the pancreatic swelling. It seemed obvious that bile, which in experiments reproduced so accurately the lesions of pancreatitis as in the human, must be the one cause. The problem, therefore, was how to explain its entrance into the pancreas, in the absence of any obstruction *e. g.*, a stone or plug of mucus at the outlet of common d. As the obstruction would be anatomic or physiologic, it seemed only natural to postulate a sphincter at the outlet of common d.

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(4) Surg., Gynecol. and Obstet., May, 1919.
(5) Ibid., June, 1919.

Oddi (1887-8) studied this muscle both physiologically and anatomically. Finding the sphincter in dogs was able to resist a pressure of 50 mm. Hg., about 675 mm. of water. He demonstrated in sections that the sphincter was composed of a special bundle of circular fibers. That the common d., outside its course through the bowel wall, possesses no muscular fibers. From the physiologic side he discovered this sphincter could be put into spasm by a mechanical irritation of the duodenal mucosa, or by application of dilute HCl in either the duodenum or the stomach; and even mere cutting of the bowel to expose the papilla would cause spasms lasting 20 to 30 seconds. Stimulation of the vagus apparently provoked a very prompt and intense contraction. A like result was obtained by stimulating the central end of the cut sciatic, while stimulation of the splanchnics had no effect. He also observed dilatation of all the extrahepatic ducts in dogs deprived of their gallbladder. He thought a catarrhal duodenitis was a stimulus to the sphincter, and might explain some obscure cases of icterus.

The authors confirmed these findings, and also noted that bile can be forced under pressure into the pancreas, and set up various grades of inflammation from chronic fibrous pancreatitis to the fulminating type with death in 20 min.

THE SPLEEN.

Lake and Kevin[7] had under observation a man, aged 24, with *internal hemorrhage due to splenic infarct.* Admitted Sept. 28, with diagnosis of nephritis, treated for nephritis; not much improvement. Dec 3rd and 4th he complained of pain in l. hypochondrium with tenderness. The following day he suddenly became blanched, the pain meanwhile increasing, the pulse very rapid and thin; temperature subnormal. Shifting dulness in flanks more marked on l. side was noted. A diagnosis of internal hemorrhage from the spleen was

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(7) Lancet, July 5, 1919.

made; cause doubtful. A few old and recent pin-point hemorrhages in conjunctivæ; retinæ normal.

When the patient reached the operating theatre his general condition was so bad it was decided to transfuse before operation. The patient improved somewhat, but was, however, obviously still bleeding rapidly and died before operation could be undertaken. Necropsy showed heart very enlarged; aortic and mitral valves sclerosed and on the surface many old and recent vegetations. Both lungs edematous. The peritoneum contained a large quantity of partially coagulated blood. One-third of spleen had been converted into a large infarct extending back to the hilum. Under the capsule, which had ruptured at one spot, was a fairly recent mass of clot; hemorrhage was proceeding directly from aperture in splenic artery. The mucosa of stomach and intestines showed similar points of hemorrhage. The case was obviously one of infective endocarditis, with an infected infarct which had ulcerated through the artery.

Injuries. V. Pauchet[9] had an *unfortunate sequel* to an operation for an ulcer on lesser curvature. During the freeing of the adherent stomach, a small tear was made in lower pole of spleen. It seemed insignificant, yet caused death from hemorrhage the same day.

Three splenectomies for war wounds were done by M. Drouin.[1] This represents nearly 10% of his operations for abdominal injuries; in the collection made by Bergeret (1917) it was only 3.3%. Two of the wounds were due to shell fragments, the other to a stab. The 2 recoveries were operated on in 3 hours; the fatal one, from shell wounds, in 4 hours. Here the lower pole was completely separated, the kidney perforated, several wounds found in extremities as well, and death ensued in 48 hours.

The symptomatology is very vague, and very often can only be suspected by the course taken. The signs of internal hemorrhage are most important. However, the absence of signs of acute anemia does not preclude wound of the spleen, for sudden death has occurred on 2d- and even on 6th day.

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(9) Presse Méd., March 3, 1919.
(1) Jour. de Méd. de Bordeaux, March 10, 1919.

In 56 cases (Bergeret), the nature of operation was: Suture, 2, both fatal from hemorrhage, one next day, the other a few days later. Tamponnade, 12, with one death. Splenectomy, 42, with 26 deaths.

Four *ruptures of the normal spleen* were met with by A. M. Willis[3] in about 3 years, all males. They had the following points in common. Blow over splenic region, no external evidence. Secondary anemia and leukocytosis. Rigidity and tenderness of abdomen. All had shock following splenectomy.

All the spleens were practically normal in size with short pedicles and without any history of previous disease. Three had agonizing pain in l. shoulder, which was promptly relieved by splenectomy. The 4th was a child sent in for concussion of the brain, semiconscious. Three were operated on 24 hours after the injury. In 2 marked increased leukocytosis persisted after operation for 2 to 4 weeks. Three had satisfactory convalescence. One died 8 days after operation, this showed a continuous fall in Hb. and a decreasing white count. In the first 2 operation was followed by direct transfusion, with apparently good results.

In the last general review (1914) some 31 cases were included, 26 splenectomies, with a mortality of 7.6%. Willis has gathered 57 since (including his own) 55 splenectomies, mortality 28.8%. Suture, tamponnade, or a combination of these two appears to give a distinctly better result. The condition at the time of operation undoubtedly was the chief factor in the mortality.

At a meeting of the N. Y. Surgical Society, F. Hawkes[5] presented a patient who had been previously shown Oct. 26, 1910, with *tuberculosis of the spleen.* He was 8 years old at that time and had been operated upon for a large adherent spleen. The spleen had diminished in size, and the boy had been in perfect health since then. When shown Nov. 13, 1918, his spleen was not palpable. His operative scar was solid. He had been at work, doing overtime work as well.

W. Meyer considered it very interesting that a tuberculosis of the spleen was affected by laparotomy in

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(3) Surg., Gynecol. and Obstet., July, 1919.
(5) Annals of Surg., January, 1919.

the same favorable way as are so many cases of tuberculous peritonitis. The good condition after a number of years certainly points in this direction.

In *4 splenectomies* for disease done by E. M. Prince[6] each was followed by operative recovery. The organ in the last case weighed 13½ lbs., even after all blood was allowed to escape. He observes the operation is usually not difficult, although if there are adhesions present and the organ is large it may cause some anxiety. If the pedicle is very short, it will add materially to the difficulty, just as in nephrectomy. The artery may be ligated separately, also the veins one finds in the pedicle. He first ligates the pedicle *en masse,* and then, ligates separately the vessels, which may readily be picked up after the organ is severed. Unless there is some oozing, which cannot be entirely controlled, drainage is unnecessary.

Two cases have been followed for 10 years. In some respects the blood after operation, has presented many of the usual phenomena reported by other operators; in some respects it had differed materially.

Cysts. A non-parasitic cyst was operated on successfully by A. V. S. Lambert.[7] A women, of 34, in 1906 had l. side severely bruised in auto accident, in bed for 3 weeks. In May, 1915, began to have dull pain in the epigastrium while walking. It was not constant at first, nor did it at this time have any relation to ingestion of food. She had no nausea or vomiting. The pains gradually grew worse and more frequent, and in July, 1915, she began to lose weight, and by January had lost 36 lbs. In October, 1917, she was placed on a strict Lenhartz gastric-ulcer treatment and spent most of the time in bed until January, 1918. Improved greatly and at the end of this period she had regained her weight and a great deal of strength. She soon returned to the regular routine and commenced to eat a simple general diet. After a very short time her old distress returned and even more severe than before the Lenhartz treatment. Admitted July 8, and splenectomy done 2 days later. Two prominences on convex surface

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(6) Surg., Gynecol. and Obstet., June, 1919.
(7) Annals of Surg., January, 1919.

which proved to be loculi of a cyst, joining each other, contents thick and glairy amber-colored fluid.

There are many explanations of the pathogenesis, and from a study of the case reports and histologic findings it is evident that we are dealing with a complex and not a simple problem. No single theory appears to explain satisfactorily all the cases. This is not surprising when we consider what varied pathologic pictures the different cases present. The age, and sex, and numerous diseased conditions have been invoked as contributory causes. Pregnancy and malaria are the most constantly mentioned. No closer connection can be established than to state that among the cases reported there are more women than men, that many of the patients have had malaria and in a number the first symptoms appeared during pregnancy. On the other hand, trauma in many immediately preceded the occurrence of symptoms and the contents often showed evidence of antecedent hemorrhage. The symptomatology is largely based on pressure and the increased size. Either the condition is recognized on account of the mass of the greatly enlarged spleen, or because of it having displaced other organs. It is frequent to have gastric disturbances. Vomiting is often present. The majority complain of pain, for the relief of which the patients first consult a physician. There are no symptoms of disturbance in the splenic function. The majority of cases are not associated with dense vascular adhesions and splenectomy has become the treatment of choice.

THE KIDNEY.

Technic. The "*kidney rest*" illustrated has been used by H. B. Devine[8] for 6 years with great satisfaction. It is of copper and fashioned on a mould from the concavity of a medium-sized man in acute lateral flexion. The underneath leg is flexed at r. angles and the uppermost thrown somewhat dorsalwards; this position, once properly fixed, will need no further adjustment. Because of the acute flexion the kidney is

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(8) Med. Jour. Australia, March 29, 1919.

very easily delivered. Elevation of the shoulders, if the table allows the movement, relaxes the muscular strain and facilitates suture of wound or the support may easily be removed prior to suture by grasping the farthermost bar and rotating the rest.

Can be used also in another way. There is a class of chronic case in which it is impossible to be sure whether the trouble is entirely due to a kidney lesion or where an adequate cause may not be found in exploring the kidney. In these patients, if the thighs and legs be flexed, the peritoneum in the kidney wound can be widely opened and the appendix removed, gallbladder explored and, if necessary, a limited examination made of stomach and other organs. Through this incision, the other kidney may be palpated preliminary to nephrectomy.

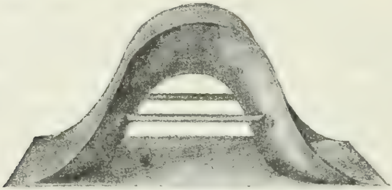

Fig. 153. "Kidney-rest" (Devine).

For *suspension of kidney,* R. M. Penick[9] uses a technic as follows: Approach through upper lumbar trigone. When the deep lumbar fascia is reached it is opened with a clean cut, and beginning at the lower angle of wound a ribbon of fascia is dissected about ⅔ in. wide. The end is secured with a hemostat and laid aside for the present, and the operator proceeds to deliver the kidney up into the wound as usual. The perirenal fat is stripped to the hilum and the capsule incised and dissected, the sutures introduced, 2 on each side. These sutures are caught in hemostats and laid aside while the perirenal fat is gathered by a circumferential large suture, forming a cup-shaped support

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(9) New Orleans Med. and Surg. Jour., April, 1919.

under the kidney, and the ends are left long for later attachment at the lower angle of the wound in the musculature. The ribbon of fascia is now picked up and a large chromic gut suture threaded into the end to prolong it; it is then fitted around the lower pole of the kidney, just below the hilum, and a stitch securing it to the capsule of the kidney near the front is introduced to prevent slipping. The ends of the suture, prolonging the ribbon of the fascia, are left in the hemostat while the kidney is being replaced, and the sutures of the capsule are secured in the adjacent musculature, as usual. When this stage is reached the kidney is placed in the position desired and the suture prolonging the ribbon of fascia threaded on a carrier or large needle and fixed in the muscles of the back, at the most convenient point, fitting snugly around the kidney and holding it securely while the denuded surface on the kidney forms adhesions. The large sutures in the subphrenic fat securing a support under the kidney are now drawn sufficiently taut, forming a cup-shaped support. This last procedure closes the loose space under the kidney and, while it may not be necessary, it is quickly and easily done.

[Werelîus' "basket-handle operation," in which the capsule is used was described and pictured in the 1914 volume (p. 512). The original operation by Hahn (1881) consisted in fixation of the fat capsule. Not long ago the number of methods proposed was nearly 100, and about every available tissue in the locality has been suggested or used. Psoas magnus (Jacobovici); p. parvus (Lenk); Quadratus lumborum (Kukula); Sacrolumbalis (Vulliet); fascia lata (Kocher); resection of 12th rib, and utilizing periosteum (Mariani), etc.—Ed.]

Malpositions. Of *19 ectopic kidneys* met with at the Mayo Clinic, according to Judd and Harrington[1] operation for some pathologic condition was done in 9. This particular malposition is rare.

The kidney may functionate in a perfectly normal manner in this position and it may never be discovered or if discovered it will not require treatment. The

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(1) Surg., Gynecol. and Obstet., May, 1919.

condition is of interest when the kidney becomes involved in some pathologic process such as hydro- or pyonephrosis, or tuberculosis. Under these conditions the location of the kidney may be misleading in the diagnosis, which, however, can accurately be made by a careful examination of the bladder, meatus, and kidney by the cystoscope, ureteral catheter, and pyelogram. After the diagnosis has been established, the treatment is the same as for a kidney in normal location.

Injuries. Immediate treatment of *war wounds of the kidney* is discussed by L. Thevenot.[2] Such injuries may be divided into several classes: (1) Wounds of kidney alone; (2) of kidney and thorax; (3) of kidney and abdomen; (4) those involving all three.

(1) Here intervention will vary according to the extent of lesions, and whether—or not—the projectile is in situ: (*A*) as a general rule, all projectiles retained in kidney, should be removed as soon as possible, for they expose the organ to infection; (*B*) Lesions of the vascular pedicle call for nephrectomy, gangrene of the parenchyma being fatal after ligation of the artery; (*C*) Lesions of the renal pelvis, on the contrary, closing spontaneously, do not necessitate any radical operation; all needed is a drain to carry off the urine externally for a time; (*D*) Punctiform wounds of the parenchyma, healing spontaneously do not call for any special treatment; (*E*) A certain number of limited wounds (tangential seton-wounds) bleeding but little, but liable to be followed by more profuse hemorrhage, can be treated by simple drainage; tamponnade or suture; (*F*) Large wounds, shatterings of the organ, are to be treated by tamponnade or lumbar nephrectomy, depending on the general condition.

(2) In this class, the kidney wound is more important, the chest lesion being secondary: (*A*) In punctiform wounds abstention, pure and simple should be the rule, the chest wound will heal with rest as does the renal one; (*B*) In large wounds, on the other hand, we can, according to the extent of the lesions and the general condition, follow several courses—either suture of kidney through wound in diaphragm, with subse-

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(2) Lyon Chirurg., January-February, 1919.

quent closure of the gap in latter, or tampon the kidney, leaving a gauze strip through diaphragm, or, finally, after prolonging the incision down, remove kidney, close diaphragm, and drain thoracic incision or close it.

(3) Here, on the contrary, the renal wound is secondary, the abdominal one most important. (*A*) In punctiform wounds, abstention is still permissible; (*B*) In large wounds, laparotomy is called for, after the abdominal lesion has been treated as deemed best, according to the length of the operation and the general condition, either transperitoneal nephrectomy is done or simple tamponnade.

(4) While the cases in this class seem complex, in reality the indications are rather precise: (*A*) With punctiform wounds, the thoracic and renal lesions can be left without operation, the surgeon giving his attention to the state of the abdominal wounds; (*B*) Given a large wound, the abdominal lesion is still most important—tamponnade with transthoracic gauze drain or intraperitoneal nephrectomy with transthoracic drainage complete the first intervention.

A series of 30 of these renal injuries were treated by Thevenot: I. Limited lesions—7 abstentions, all recovered; tamponnade, 4 cases, 1 death; simple drainage, 10, with 2 deaths. II. Extensive lesions—tamponnade, 1, rapidly fatal; nephrectomy, 8, 7 deaths, 3 from hemorrhage, 4 from accompanying intestinal lesions.

A rare accident—*rupture of a cystic kidney*—occurred in a young man operated on by C. W. Sharples[3]. When 17 he had recurrent abdominal pains and r. lumbar pains of a few minutes' duration and, when he was prevented from urinating, the pain in the bladder became more intense until it was emptied. For past 2 years when lifting there was pain in lumbar region.

While wrestling fell and opponent's knee struck him in r. lumbar region. At operation in 4 hours no rupture of abdominal viscera nor fluid of any kind in cavity, but there was an edema located in mesocolon and retroperitoneal. When the mesocolon was inspected, it was fully 1 in. thick in places and, when grasped, felt like any other edematous tissue, boggy and heavy. Around the duodenum was a similar edema. Along the post. wall of peritoneum there appeared a like condition. It then occurred to Sharples there might be a rupture of kidney, since the edema was around the duodenum and also in view of the knee having been forced into r. flank. He could feel not a normal kidney, but an irregularly shaped mass, from which he concluded he had to deal with a ruptured cystic kidney. The abdominal wound was closed with drainage, the right flank opened and a large cyst that had collapsed removed. There also appeared during this second operation a considerable quantity of fluid. It was a monocystic kidney. The wound was drained. The man outside of a phlebitis in the opposite leg, made a good recovery.

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(3) Northwest Med., June, 1919.

[Rupture of the polycystic organs is by no means common, *e. g.*, it did not occur in the 41 cases at the Mayo Clinic (1918 volume, p. 541). However, another was noted in the 1911 volume (p. 530), and still another was reported, also in U. S., a few years before.

In the remarkable case recorded (France) by Montpeurt, several years back, a solitary cyst was so large it produced a hernial protrusion in lumbar region, yet in spite of this large size and liability to trauma, it was operated on before rupture took place.—Ed.]

Infections. In a man, of 38, under the care of L. Buerger[4] severe infection occurred in one-half of *a kidney with double pelvis.* The *x*-ray showed a vesical calculus, and in l. renal area over 11 and 12 ribs was an irregular, sausage- or kidney-shaped shadow suggesting the presence of more than one calculus, and measuring 1.75×.75 in. The renal shadow indicated a considerably enlarged organ.

In a man who had had a large vesical calculus, and in whom the *x*-ray findings indicated the presence of a fair-sized calculus in l. kidney, the clinical course as well as the cystoscopic findings, pointed to severe infection of at least the upper half of the kidney, the lower pelvis being uninvolved. The insidious nature of the process as evidenced by the absence of local pain, renal colic, or local tenderness, the presence of attacks of fever with general symptoms rather than localizing

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(4) Surg., Gynecol. and Obstet., February, 1919.

phenomena, made the interpretation of the clinical course and the surgical indications somewhat difficult. However, from a consideration of the findings, it was possible to make the following deductions:

That the upper portion of the kidney was the seat of an inflammatory process with multiple abscesses, or at least extensive pyelonephritis, and suppurative areas in the parenchyma; and furthermore, because of the long history, and the absence of a true pyonephrosis (as indicated by cystoscopic findings), and the absence of pain and tenderness, he was in all probability dealing with an inflamed kidney, whose exterior was enveloped in markedly thickened perirenal adipose tissue, *i. e.*, a kidney surrounded by enormous fat production, and enveloped as it were, or encased in a mass of inflammatory tissue. The operative findings corroborated these inferences in revealing a kidney that corresponded almost exactly to that Buerger had expected to find. Nephrectomy; uninterrupted recovery.

Considering *dilatation of the ureter and renal pelvis,* W. F. Braasch(5) observes that when viewed from a clinical standpoint, the subjective data accompanying mechanical and inflammatory dilatation are quite distinct. It is difficult to conceive that there may be, without pain, an intermittent mechanical obstruction, with consequent overdistension of the pelvis and ureter by the retained urine. In the majority the pain is usually great, although with partial obstruction it might be of a moderate character. With the dilatation such as is so frequently seen with chronic pyelonephritis, however, there is usually little or no pain referred to the kidney. If a history of definite pain is present, there must be some complicating mechanical obstruction present.

Tuberculosis. Braasch and Oleson(8) state the *roentgenographic data* in renal tuberculosis are regarded of such importance at the Mayo Clinic that it is a rule to make a complete examination of the urinary tract in every case in which tuberculosis is suspected. The frequency with which positive data may be obtained in the roentgenogram is evidenced by the fact that in 1916-17,

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(5) Jour. Amer. Med. Ass'n., Sept. 6, 1919.
(8) Surg., Gynecol. and Obstet., June, 1919.

131 patients were operated on for tuberculosis, and positive shadows suggestive of tuberculosis were found in 30.

Such roentgenographic data are of particular value in conditions as follows: 1. When, because of the contracted condition of the bladder or impassable stricture of the ureter, the cystoscopic findings are inadequate. 2. When the cystoscopic findings are not typical tuberculosis. 3. When the clinical findings are not suggestive of any involvement of the urinary tract, as may occur with a closed tuberculous pyonephrosis. 4. In bilateral tuberculosis when the typical shadows frequently render further examination unnecessary.

The shadows are caused by the deposit of calcium in the tuberculous area and may assume a variety of forms. To one who has had considerable experience in interpretation, such shadows will have characteristics that are usually recognized. They may be differentiated from a stone shadow by (1) the variability in its density, as the shadow is irregularly concentrated in different portions, (2) by a shadow of lesser density throughout than that usually observed with stone, and (3) by its irregular and indefinite outline. The calcareous area may, however, simulate a stone in every particular, and it may be quite impossible to differentiate it without further clinical data. The same is true of renal stones that are occasionally seen of such consistency the shadow will be fully as irregular and hazy as a typical tuberculous shadow. It may be said, however, that approximately 75% of tuberculous shadows may be recognized as such.

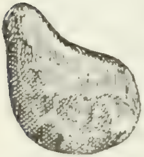

Fig. 154. Size and shape of calculus in 4 cases (Harries).

Calculus. In the 1918 volume (p. 540), we referred to the *frequency of urinary calculi in India;* of course, in the natives. D. J. Harries[9] writes that in the English troops—of 1,455 operations in 19,020 admissions during 2½ years, only 6 operations were done for calculi over ½ in. wide.

In his article on "*cases simulating renal calculus,*" D. Newman[1] begins by referring to the well-known ten-

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(9) Indian Med. Gazette, June, 1919.
(1) Glasgow Med. Jour., April, 1919.

dency of rare conditions to occur in succession. Many years ago he had under observation at the same time 3 cases of cystinuria and one of cystin calculus. This was a very exceptional experience, as since then he has come across in practice only 2 cases of cystinuria and one of calculus. *I. e.*, 7 cases of cystinuria which have fallen to his lot, 4 presented themselves almost simultaneously.

Within the last year he had a similar experience in private practice of 3 cases closely simulating renal calculus, not only in symptoms but also in physical signs. There being no safe short cut to diagnosis, it is necessary, even in those which may be looked upon as the simplest cases, to employ all our methods of investigation.

I. Shadow simulating renal calculus on the r. side, at the level of last rib and 2 in. from spine—Severe pain in lumbar region—Occasional slight pyuria from kidney—No tubercle bacilli discovered, only *B. coli* found—Deposits of uric acid frequent—Pyonephrosis developed later—Nephrotomy—Good result.

II. Shadow in renal region simulating calculus—History of pain in lumbar region of 4 years' duration—Painful micturition—Rheumatism—Occasional slightly purulent urine—Oxaluria—Shadows increase in number, wide distribution—Ureter orifices normal—Ultimate diagnosis; rheumatism with calcareous deposits.

III. Pyuria of 3 years' duration associated with pain in kidney—No hematuria—Testicular pain—Frequent and painful micturition—*X*-ray showed shadow in renal region—Tuberculous pyonephrosis—Nephrotomy.

(A 4th one, so closely resembled some of those of renorenal reflex pain that the symptoms, especially the occasional pyuria, the oxaluria, and the *x*-ray shadow, led to an exploratory incision, but in place of a stone a calcified gland was found.)

A. J. Ochsner[3] discusses *treatment of renal and ureteral stones from the standpoint of the clinical surgeon.*

His paper is based in experience dating back to 1887, when he assisted Prof. C. T. Parkes in the diagnosis and operation of one of the earliest cases in the U. S. The year following he was directed by Parkes to keep a colleague under chloroform at intervals from 10 a. m. to

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(3) Jour. Amer. Med. Ass'n., Oct. 11, 1919.

8 p. m. while a calculus was passing through the ureter. For several years, this physician had passed one to three renal calculi annually. Morphin had no effect on him, so anesthesia was the only hope of relief.

A few days later, before this patient had time to produce another calculus, Ochsner met another of Parkes' patients who had suffered from recurrent renal colic, a manufacturer of steam boilers. On asking him whether he had experienced any attacks recently, he stated he was definitely through with colic, and suggested that if the doctors used their intelligence as actively as boiler manufacturers had to, no one would ever experience a second attack unless he had more than one stone to begin with. He stated that when his customers complained of their boilers filling up with scales, he advised them to use rain water, and this ended the trouble; so on the same principle he drank freely of distilled water, and had been free from a recurrence of stone and colic. Ochsner immediately put his colleague on this treatment, which he continued 29 years, never having another attack. He died of cerebral hemorrhage at 74.

Since that time, he has made use of this method in an enormous number of cases, always with the same result; and the practice has been followed by many practitioners who have visited his clinic and others who have read about this method of treatment. The method must have been used before the boiler maker discovered it, but earlier reference to it has escaped his attention, except that the water from certain springs which is almost as free from lime as is distilled water has been used as a prophylactic against recurrence of renal colic from time immemorial, while regions in which the drinking water is loaded with lime salts are notorious for the frequency of calculi. A number similar to the following have proved the importance of this treatment:

A farmer, aged 34, from the limestone region of Wisconsin, came to clinic with recurrent renal colic 27 years ago. During former attacks, he had obtained relief spontaneously, but this seemed more severe. The stone passed on 2d day under treatment with morphin and atropin hypodermically, and 2 oz. of glycerin and large quantities of distilled water, all of which were repeated after

24 hours. He obtained a distilling apparatus and drank only distilled water for 12 years without having any further attacks until he drank well water for 6 months, being too much occupied while building a new house to take the distilled water. This brought on another attack, during which he passed a calculus 1.5 cm. long. He immediately returned to distilled water and has now been free for 15 years.

Conclusions as follows are reached:

1. The size of the pelvic stone will usually determine the possibility of its passage spontaneously. In Ochsner's experience when several stones were present in the pelvis, the patient never passed all of these spontaneously.

2. In the ureter the primary stone, if it gets started will usually pass. Subsequent stones may be stopped by cicatricial contractions which may have been caused at some point by injuries due to the passage.

3. A large proportion of stones of moderate size will pass spontaneously or after dilatation of the ureter with bougies, the use of oil or glycerin injections or one of the various methods of dilatation of which the one perfected by Lespinasse seems most effective.

4. At times simply starting the stone with a bougie will suffice.

5. In cases suffering from acute renal colic, the use of morphin and atropin hypodermically followed by the ingestion of 2-ounce doses of glycerin with large quantities of distilled water has seemed to be of value in aiding the passage of stones spontaneously, especially, when patient was immersed in a very hot bath.

6. The taking large quantities of distilled water seems to be effective in preventing recurrences.

7. Sinuses remaining after pyelotomy or nephrotomy will frequently heal after injection with bismuth paste.

8. The clinician who is alert for the discovery of renal or ureteral stones who takes into consideration the history and physical findings will rarely miss a correct diagnosis provided he confirms his diagnosis: (*a*) by careful urine examination; (*b*) by *x*-ray examination with intensified shadows if necessary; (*c*) by the introduction of ureteral shadow sounds; (*d*) by pyelography in doubtful cases; provided he is willing to consider all

points as a whole and will place no weight upon negative findings by any single one of the various methods.

The well-known Danish surgeon, Thorkild Rovsing[4] furnishes an account of a long experience—25 years'—in the *diagnosis and treatment of renal calculi.* A total of 533 cases, including 185 with blood borne infection and 221 in which the operation revealed aseptic conditions, with 127 aseptic cases in which no operation was attempted. In the majority of the surgical cases the stone caused no symptoms until suddenly pains with hematuria or pyuria attracted attention; this may occur at any time from early childhood to advanced age. When a stone of this kind has been removed, the kidney shows no tendency to form other concretions. A transient fever, or a course of one-sided diet, may produce urates in such amounts as to entail a kidney stone. On the other hand, it is extremely rare for the congenital uric acid diathesis to entail stones calling for intervention. Pains and hematuria in these cases are generally traceable to uratic nephritis or perinephritis for which nephrolysis seems to be the best treatment.

Phosphaturia is frequently accompanied by large concretions; in 4 cases in which the tuberculous kidney had been removed, anuria developed later and he found the pelvis filled with phosphate stones, one of which had become impacted in ureter. Most phosphate stones are due to accidental or artificial phosphaturia. Frequently this is the result of a course of mineral waters, possibly given to combat nephrolithiasis, regardless of the law that when a foreign body is laved in a solution of a salt, it becomes incrusted with the salt, even when the urine is limpid and sterile. Long treatment of rachitis with calcium salts may also lead to stone production.

Rovsing has encountered only 2 cystin stones and both patients were permanently cured by removal of the stones and restriction afterward to distilled water.

In some cases the disturbances from the supposed kidney stone proved to be due to the binding of the kidney in the fibrous degenerated true capsule; slitting this and releasing the kidney cured the disturbances. In other cases a partial hydronephrosis from some aberrant

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(4) Hospitalstid (quoted in Jour. Amer. Med. Ass'n., April 4, 1919).

vessel was the cause of the pains and hematuria, or a movable kidney, or appendicitis simulated stones. Appendicitis can be differentiated by the pain induced in the cecum by pressure on desc. colon. Again and again, he states, patients sent in with the diagnosis of appendicitis failed to respond positively to pressure on the colon, exculpating the appendix, although there was pain at McBurney's point and the urine was limpid and nearly or entirely free from albumin; a stone impacted in the ureter was responsible. In such cases the apparently normal urine may show microscopic hematuria. On the other hand, pressure on the desc. colon may point to the appendix when the colic and hematuria prove to be merely the results of complicating colon bacillus nephritis. The dire effects of an utterly unnecessary nephrotomy in such a case are obvious.

[This diagnostic method for appendicitis is described in the 1908 volume (p. 434). However, it is not as reliable as he believes, and several figures on this aspect will be found in the 1910 volume, p. 431.—Ed.]

With radiography it is important to inspect both kidneys and both ureters and the bladder as well. The stone may be found in the apparently sound kidney. Out of 195 instances where a stone was found at operation, in 32 the *x*-ray was negative. In 6 others the findings were absolutely misleading. In still other cases, on 4 occasions colics due to various causes were present with calcified nodes, and the latter mistaken for renal calculi.

In treatment copious drinking of distilled water is advised. Patients can take 2 or 3 liters, but between meals and in small quantities, not over a quarter-tumblerful at a time. No action can be expected save in urate- and oxalate-stones, no larger than a pea, but in these the water often is completely successful. It is also very useful preparatory to operation in infected cases, as well as postoperative. By ridding the organ of a certain amount of toxins and bacteria, an absolutely inoperable bilateral case may become operable, and even if inoperable, many patients remain in good condition for years. One woman has kept in good condition for 25 years on 2 liters of distilled water a day, though there is still coliuria, and a large stone present in kidney.

[The reno-renal reflex in which symptoms are referred to the sound side is discussed in the 1919 volume, p. 550.—Ed.]

Tumors. E. S. Judd[5] of the Mayo Clinic discusses *papillary tumors of the renal pelvis.* Their genesis is not clear. Stones occur in the pelvis in about 15 per cent. and these have been suggested as a possible factor. The papillary structure is regarded as proliferating epithelium of the renal pelvis, and the exact nature of the tumor seems to be based on the appearance of the epithelial cells within the connective tissue beneath the tumor. These tumors of pelvis are unlike the papillary adenomas of the parenchyma, as the former do not invade the kidney, but tend to pass down ureter. The papillary adenomas arise from the epithelial cells of parenchyma, while the squamous-cell papillomas start from the epithelium of the pelvis. The latter may be compared with the intracanalicular papillomas in the ducts of the mamma, while the former may be compared with the cystadenomas that occur in the breast. Papillary tumors in renal pelvis are usually, if not always, multiple. They may be divided into: (1) Simple papillomas which show throughout their entire development the characteristics of all such tumors; (2) the epithelial papillomas which almost immediately show malignancy; and (3) those tumors which apparently change from a supposedly benign to a malignant growth.

Of 207 renal tumors at the Clinic, there was but one definite papilloma of the kidney and ureter.

A review of the histories of 3 papillary adenomatous tumors would seem to indicate that pain in the region of the affected kidney, extending into the loin, is a common accompaniment of renal adenoma, and patients thus afflicted quickly show emaciation. A palpable tumor was present in all cases. Blood in the urine is a common symptom in malignant tumor of the kidney, except sarcoma, which occurs almost altogether in children. Blood coming from one kidney should suggest tumor of the kidney. In this connection it is necessary to keep in mind the possibility of tuberculosis, and also those unexplained cases of essential hematuria. The bleeding in

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(5) Journal-Lancet, May 15, 1919.

their case of papillary tumor of the pelvis was different from that which occurred in the 3 papillary adenomatous tumors. In the first case it occurred in hemorrhages, and the urine was otherwise clean. In the papillary adenomatous tumors a great deal of blood and pus in the urine was a constant finding. The *x*-ray shadows showed stone, and this led them to think that pyonephrosis and calculi might be present. It seems to Judd that a colloidal silver plate of the pelvis in a renal papilloma might be quite suggestive, and possibly a diagnosis could be made; at least a cystogram of the bladder in which a papilloma exists usually gives a characteristic picture. In examination, and especially in the treatment, we must bear in mind the possibility of the existence of a papilloma in the ureter alone which will produce these same symptoms. This is very rare, though there are a few on record. (Plates XLIV, XLV).

Nephrectomy is indicated in squamous-cell papillomas and papillary adenomatous tumors of the kidney if the opposite kidney is in good condition. Conservative treatment is almost conclusive evidence they will recur elsewhere, and immediate change to a malignant growth is possible. The most probable point at which broken-off pieces find lodgment is just at the ureterovesical junction, hence the surest cure is to remove the entire ureter.

THE BLADDER.

Drainage. Beal's suprapubic syphon for bladder was figured in the 1919 volume (p. 553). A *simple method* is described by E. D. Martin.[6] All necessary is a large catheter, *A*, and a piece of rubber tubing, *B*, ½ in. in diameter, long enough to reach from the apex of bladder to 1 in. above skin. Several small holes are cut near the end to be placed in the bladder, *C*, and one at the level of the skin, *D*, large enough to insert the catheter snugly so the urine will not escape. The catheter is pulled through this opening to about 1½ in. from the bottom of the large tube, *E*, the tube is introduced into bladder and the wound closed tightly around

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(6) Surg., Gynecol. and Obstet., January, 1919.

it. As soon as the urine rises in the tube above the point where the catheter is inserted, *D*, it will prime the catheter and empty the bladder. It is simple and most effective. This apparatus, like others of its kind, needs intelligent handling. In flushing the bladder the fluid is sent through the catheter and flushes the large tube, cleansing the bladder at the same time. This drain is used until the urine is free of clots and necrotic tissue. When removed a Pezzer catheter is inserted and kept in as long as necessary.

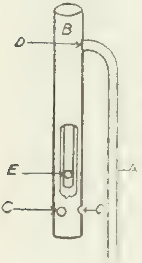

Fig. 155. Apparatus for bladder drainage (Martin).

Attention is drawn by H. C. Orrin[7] to the value of the *syphonage method in severe bladder injuries.* On Sept. 1, a soldier was wounded, part of abdominal wall being carried away, and with it a portion of ant. vesical wall. He reached England on 30th, and no urinary case could have been more septic, foul, and hopeless. Yet with this syphonage alone, and without operation, complete healing was obtained.

The apparatus is simple, and can be so finely adjusted as to draw away the urine at a rate synchronous with its excretion from the kidneys. *A* is container for the urine, fitted with an air-tight rubber stopper. Through this pass 2 short glass tubes. To the one is attached the

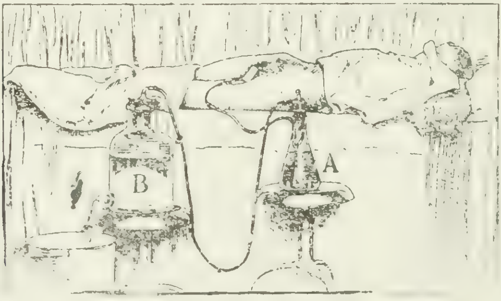

Fig. 156. Syphon drainage of bladder (Orrin).

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(7) Practitioner, October, 1919.

catheter, and tubing; from the other, another tubing connects with the vacuum jar *B*. This is large and has an airtight cork at top with r. angle glass connection, and the outlet has a thumb-screw. *B* is filled $\frac{2}{3}$ with water, and the connection between it and *A* coupled up. The outflow from *B* is now opened, and as soon as sufficient water has escaped to establish a vacuum, air is drawn from "*A*," which produces a syphon action.

One of the essential features of the prolonged drainage of the bladder is the toilet of the penis. The fairly frequent changing of the catheter so as to lessen, if not altogether to avoid, urethritis is of the highest importance. The urethra should at the time of changing the catheter be flushed out with 50% warm eusol.

Foreign Bodies. Details are given by G. P. LaRoque[8] of an *extremely interesting case.* The patient, aged 34, had had l. ovary removed and uterus suspended. No symptoms resulted during five years. Sudden apparently causeless onset of bladder tenesmus and suppuration was followed in 3 weeks by spontaneous expulsion of a gauze sponge (2×10 in.) to the meatus and easy delivery was accomplished by traction. Instant relief of tenesmus, rapid subsidence of all symptoms, in a week spontaneous closure.

[See also Mercadé's equally remarkable case—Intestines.—Ed.]

Gasoline was used successfully by B. H. Caples[9] *to dissolve a paraffin pencil.* This was whittled out of a candle, was 2 in. long and .3 wide; inserted to conceal urethral discharge it passed into bladder. Three days later 125 c.c. of gasoline was injected and retained for 90 min., this was repeated 6 times in 3 days.

[A similar plan was made use of by Lenk (1908) only benzine was injected to dissolve a wax taper. The same year Posner dissolved a medicated bougie of cocoa-butter. In this country, VanMeter (1912) removed a piece of paraffin-chewing gum.—Ed.]

Diverticula. F. Hinman[1] analyzes *21 examples* of vesical diverticulum met with in 4 years. It occurs most

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(8) Surg., Gynecol. and Obstet., May, 1919.
(9) Ibid., September, 1919.
(1) Ibid., August, 1919.

frequently in men over 50, the average age being 56; youngest, 37; oldest 77. It is very exceptional in women (2 cases, ages 40 and 56), and in this series no instance has been seen in children.

The diagnosis is made definitely by careful cystoscopic and cystographic study. Cystography is more accurate when both plain and contrast pictures are taken. The cystoscope is unreliable for accurate determination of the size and position, and the simple cystogram may fail to show even a large diverticulum. Properly used in conjunction the 3 methods give reliable information.

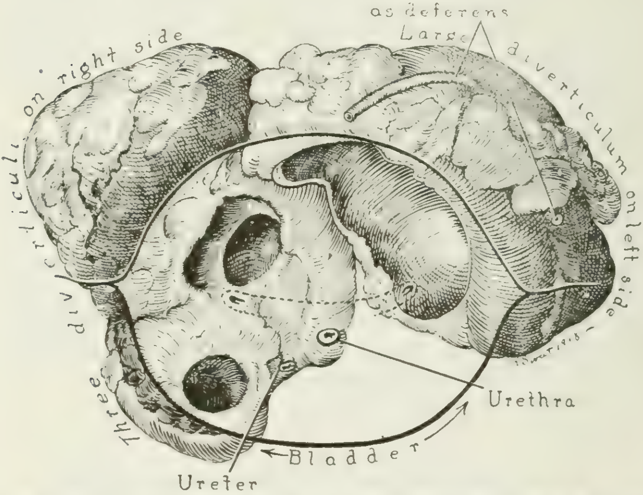
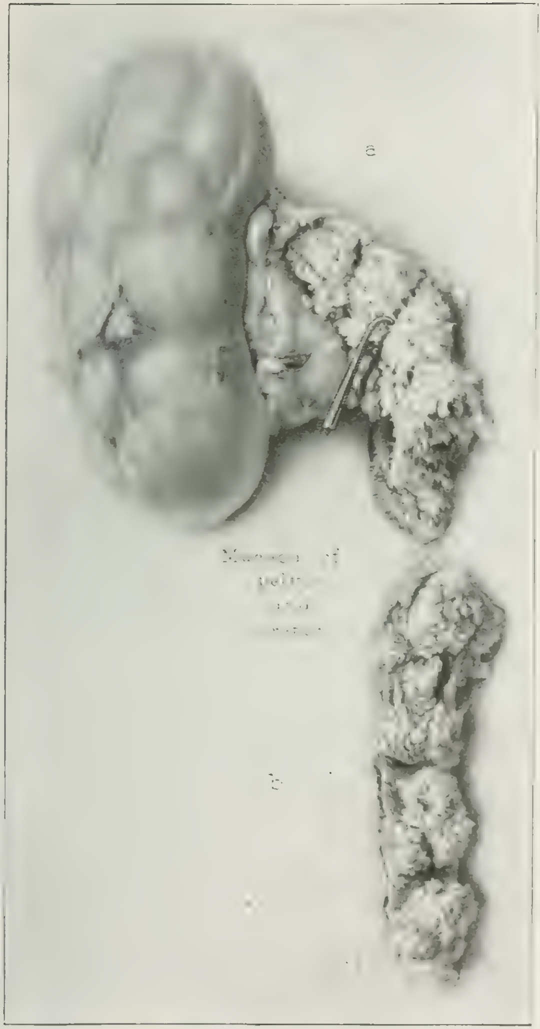

Three diverticula on right side
as deferens
Large diverticulum on left side
Urethra
Bladder
Ureter

Fig. 157. Drawing of four diverticula removed in Case 5 to show relationship to ureteral orifices. The left vas was sacrificed in the removal of the left sac which extended deeply posteriorly and in the attempt to free the ureter. The cut end of right ureter is hanging from the specimen (Hinman).

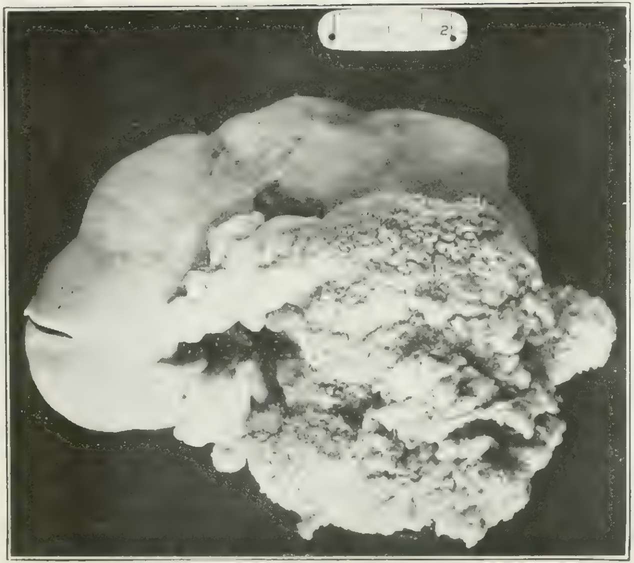
In 17 operations in which the number and relative position of the diverticula were determined by direct examination, a single large diverticulum was present in 11, two large diverticula in 4, and three and four large diverticula each in 1. In every case of single sacculation the orifice was located near an ureteral orifice. In the cases with two diverticula there was usually one each

PLATE XLIV.

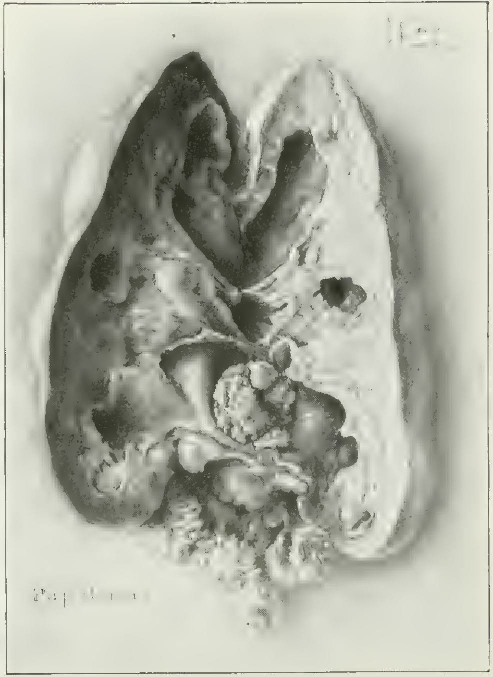


a, Kidney with pelvis and upper ureter. Incision made in pelvis and papillomas forced outward. *b*, Lower end of ureter with multiple papillomas, which probably extend down into bladder.—Judd. (See p. 540.)

PLATE XLV.



Papillary squamous-cell tumor of renal pelvis.



Same specimen, opened showing papillomas rising from mucosa of pelvis. Judd. (See p. 540.)

near the respective meatus. The base showed a diverticulum only when the neighborhood of the ureteral orifices had diverticula, and in these instances the diverticulum at the base was always the smallest. In not one of the 17 operations was one or the other ureteral orifice uninvolved.

The base and posterior walls of bladder were markedly trabeculated in every case. Large cellules easily admitting the tip of the gloved index were located in the neighborhood of the opposite ureter in 9 of the 11 cases of single diverticulum, and in the base of the bladder in 3 of 5 instances of multiple diverticula. In no instance was the mouth of the diverticulum or the cellule found on the high lateral or anterior walls. The ureter was shown by the cystogram to be markedly dilated on r. in 3 cases, and on l. in 2; both ureters were dilated once.

The walls of the 22 diverticula removed at operation vary in thickness from ¼ mm. to ½ ctm., and this variation in thickness exists for different portions of the wall of the same diverticulum, even the thickest having some extremely thin areas. There is a remarkable absence of epithelial lining which may be the result of surgical trauma. In the one case which showed a lining it was a thin pavement epithelium unlike bladder mucosa. The inner surface of all showed a chronic inflammatory reaction. The muscle of the walls had no definite arrangement into layers in any way analogous to the vesical muscularis.

A contracture of the vesical neck was found in association in 13 cases and received surgical treatment in 8. A small fibrous or ring prostatic hypertrophy was removed suprapubically in three cases and perineally once. A large glandular prostatic hypertrophy complicated two cases. The diverticula in all of these cases associated with prostatic enlargement were relatively small and were untreated surgically in three cases, in the two large glandular and in one fibrous hypertrophy. In the cases in women, which have not come to operation, no definite obstruction to urination other than that attributable to the diverticula was found.

The onset, course, and termination duplicate the picture of prostatism. Cloudy urine was first noticed on an average of 6 years, and was absent altogether in 5 cases, whereas the average duration of symptoms since onset is 16 years. Vesical calculus only once.

Hernia. E. H. Risley[2] desires to call attention to a rather unusual, but successful, method for *irreducible hernia of bladder.* The patient, aged 56, had large scrotal hernia on l. for 19 years, always reduced with great difficulty and impossible for 4 years. Usual inguinal incision carried well down into scrotum. Great difficulty experienced in locating the part of sac where the bladder was not adherent. Sac finally opened and found to contain bladder only, which was everywhere firmly adherent. It was found impossible and inadvisable to attempt to dissect bladder free from its almost complete surrounding of adhesions. It was impossible to dissect even the cord from the sac and bladder wall and, respecting the desire to save the testicle, it with the cord, sac and bladder were freed from scrotum, invaginated together, and pushed *en masse* gently through the stretched inguinal canal into the abdominal cavity and a radical cure of the inguinal hernia done. Immediately after operation the patient was catheterized with great ease. He made an absolutely uneventful convalescence, voiding regularly without difficulty or pain, left the hospital on 20th day and has been free from symptoms since. Last seen about 6 months after operation he had had no pain from his abdominally-housed testicle, no urinary symptoms, and no recurrence.

Of 3 examples of *sliding hernia* under observation by L. Frank[3] in 12 years, 2 (males, 38, 58) contained the bladder. In one a fatty mass .8×2.4 in. was attached to apex of organ. Successful herniotomy in each.

Two patients, with that infrequent condition—*malakoplakia of bladder*—were treated by A. I. Folsom.[4] Both were women, as usual, and while tuberculosis is often thought to be a factor, it seemed not in these instances. Though neither tuberculin tests nor animal inoculations were made, however, repeated stains of urine showed no bacilli. Fulguration was successfully given in both.

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(2) Annals of Surg., July, 1919.
(3) Kentucky Med. Jour., August, 1919.
(4) Jour. Amer. Med. Ass'n., Oct. 11, 1919.

[Since first described (1903) by Hansemann, a little over two dozen examples have been met with, mostly in women, and all in aged subjects except two of 11 and 24 respectively. Nearly all were necropsy findings, and as a rule, there was some coexisting chronic disease tuberculosis, carcinoma or nephritis. In 4 clinical cases, the vesical disturbances were insignificant, and the condition was discovered accidentally during cystoscopy. In one patient the urine was perfectly clear.

Some years ago Hedren observed a case in Norway, in a woman, of 45, admitted for chronic nephritis. Here also there was nothing to call attention to the bladder, and the malakoplakia was discovered at necropsy. While there were numerous bacilli, resembling the colon variety, no tubercle bacilli were found. It seems likely the affection is an inflammatory process caused by *B. coli*. In the 24-year old patient, the kidneys and ureters in addition were involved.—Ed.]

An example of *large vesical calculus* is placed on record by E. C. Smith.[5] A man, of 55, gave a history of hematuria about once per annum, starting 20 years previous, when there was also severe pain. Radiogram showed the stone filling true pelvis, it was extracted with difficulty. The weight was 40 oz., and size 3.8×5.6 in. eventual recovery.

Tumors. In a consideration of *surgery vs. radium in vesical carcinoma*, B. S. Barringer[6] gives as his opinion that while surgery could cure 15%, radium could cure 20. A series of 43 cases was treated in 3 years, 2 so-called malignant papilloma, and the rest papillary carcinoma, or indurative carcinoma, or a combination of the two. In a majority the diagnosis has been confirmed by microscopic examination.

Two of the entire 43 cases were early operable cases; too recently treated to report upon. Some of the remaining 41 might have been called operable; the operation would have to be partial or total cystectomy. On the whole, operation on these 41 would have presented but slight chance of cure.

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(5) Surg., Gynecol. and Obstet., November, 1919.
(6) New York State Jour. Med., November, 1918.

Five of the 41 * advanced cases, and 1 a post-operative case, 3 confirmed microscopically, are well, as proved by cystoscopic examination; one for 23 months, one for 12 months, one for 6 months, one for 7 months, and one on one examination. In two cases the tumor has recurred after being removed (by radium). Three or four more cases will probably later go into the cured column.

An example of secondary *melanoepithelioma of bladder*, in a man, aged 45, is recorded from the Mayo Clinic by C. G. Richards.[7] The mother died of cancer of stomach at 73, and, like the patient, had had pigmented moles irregularly distributed over entire body. For 5 or 6 years patient had noticed that a rather large mole situated on r. side of abdomen near umbilicus had a core of granular débris which could be expressed, and 2 months previously it had begun to enlarge and had a tendency to bleed. Because of the bleeding his physician excised the growth. Histologic examination revealed melanoepithelioma. Further advice was sought, and the examination was negative except for slight enlargement of the inguinal nodes. The urinary findings were negative. A gland removed was found to be malignant, and therefore all glands in both groins and Scarpa's triangle were removed; the ext. saphenous vein was ligated. While the patient was convalescing radium treatment was begun, and was continued at frequent intervals. Eight months later another small gland in inguinal region was discovered, which proved to be of same nature. Ten months later increased frequency of urination and diminution in size of stream, and nocturia noticed. On cystoscopic examination multiple areas of black rounded tumors varying from .8 to 2 in. were found on r. base of bladder anterior to meatus. Two tumors had pedicles; the others were sessile. As soon as the condition was discovered intravesical radium treatment was instituted. To the present 400 milligram hours have been given. At the last cystoscopic examination a month previous, no material change was noticeable.

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* Many cases are dead. Many came practically dying. The one thing radium does in these hopeless cases is to control the hematuria. In 9 of 10 cases the bleeding stops—generally for a period of some months. This is the decided benefit that follows radium treatment in bad cases. Whether it temporarily checks the growth is an open question.

(7) Surg., Gynecol. and Obstet., September, 1919.

[This is an extremely rare location for secondary deposits. In fact the only other we recall was the one many years ago by Targett (*Trans. Pathological Soc. of London*, 1891) also in a man, of 32. Some 2½ years previous he began to have pain in l. eye, on admission the eye was displaced, there were numerous melanotic nodules over body and limbs. Necropsy showed numerous secondary deposits in liver and lungs; also a pigmented polypus in bladder, near orifice of l. ureter.—Ed.]

THE SPINE AND CORD.

Spine. Details are given by E. Sachs[8] of *43 laminectomies:*

Cases	Number	Deaths
Tumors	13	2
Posterior root sections	9	1
Serous pachymeningitis	6	0
Negative findings	6*	0
Fractures	5	1
Tuberculosis	1	0
Syphilis	1	0
Transverse myelitis	1	0
Spinal sclerosis	1	1

As regards *diagnosis of fractured vertebra*, J. B. Hartwell[9] states it is convenient to divide them into fractures of the bodies (compression fractures) and fractures of the vertebral arches and processes. The former class result from indirect violence, but the process fractures almost invariably are due to direct trauma.

Of subjective symptoms backache—common uninteresting backache—is the chief. This is well localized and

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(8) Jour. Missouri State Med. Ass'n., April, 1919.

* Three operations on one case.

Mortality for laminectomies 11.6 per cent. Mortality for tumors and serous pachymeningitis, 19 cases, 10.5 per cent. Any cases that died in the hospital, no matter how long they remained after operation, are counted as deaths.

(9) Colorado Med., April, 1919.

absolutely constant, and does not radiate. It is exaggerated by any motion that changes the line of weight of the body. Rising from the recumbent to sitting position or from the sitting to the erect position increases the pain, but in no position is pain actually absent. Flexion and hyperextension of spine are most carefully avoided, though the pain caused thereby is only momentary. And the second characteristic of the pain, whether in compression or process fracture, is it persists unabated for months and even years. Another subjective symptom is weakness of back, though this is less constant.

In the diagnosis, whether compression- or process fracture, localized tenderness is by far the most common, as it is the most reliable sign in the long bones. In compression fractures the tenderness is over one or more spinous processes; in process fractures lateral to midline.

A second valuable and most constant sign in compression fractures is disalignment of the spinous processes. This is not apparent to sight but perfectly apparent to touch, and due to the fact in the majority the impact of the bodies is not a central one and rotation of the spine at the fracture results. Therefore, the spinous processes at this site sharply deviate to one side or the other, not a great distance but enough to be readily apparent. If in addition to the compression there is dislocation, a variation from the normal in the depth of the spinous process may be apparent.

This disalignment should be given the place in diagnosis that the books give to the elusive kyphos. In the typical, classic case with paralysis, a kyphos is expected; less sharp than in Pott's disease, but still easily observable. The kyphos in ambulatory compression fractures is often so slight that it may readily be classified as bad posture. The exaggerated upper dorsal curve seen in moderate round shoulders is the typical kyphos in fractures of the upper D. spine, while in DL. region, instead of a kyphos, the lumbar curve is lessened or obliterated, giving rise to the flat back seen in many postural strains. In the middorsal region, however, the knuckle is evident, and should give the clue. In any suspicious case, diagnosis must be decided by satisfactory *x*-ray plates, both anteroposterior and lateral.

Fracture confined to a lamina being rare, the account of one contributed by R. E. Smith[2] is of interest: Nov. 3, a sailor fell out of hammock to the flat deck 5 ft. below, striking neck near 7 C. Unable to bend or raise head without great pain; in 3 weeks under treatment for spinal contusion, all symptoms had disappeared. Later on there was a temporary recurrence, and Jan. 2, some loss of power on r. side was manifest. In 10 days numbness and coldness developed from 3d rib, down. Stereoscopic photograph shows fractured lamina of 1 D. vertebra. It extends vertically up the side of the r. plate of lamina close to spinous process and passes out towards upper edge of vertebra. The symptoms point to pressure on the 2 D. segment with partial involvement of third, probably by a descending myelitis. It was considered these were due to organizing adhesions and to callus formation. The spine was exposed. The spinous process of 7 C. and 1 D. showed evidence of recent trauma. The lamina of 1 D. was depressed, and overlapped by the lamina of 7 C. and 2 D. It was removed completely, with some difficulty. Between the fracture and dura was a strong adhesion, which had to be severed by several sweeps of a fine knife. The cord was quite free above and below, and, as the dura was otherwise normal, further intervention was avoided. Wound closed completely and splint applied. Shock marked, although operation was completed under the hour. Patient was fully recovered 9 hours later. On attempting to vomit, he inspired some of the contents and was seized with violent coughing. Before the throat could be cleared he died from syncope. Section of the cord at the site of the lesion showed an early sclerosis in the post. columns, vacuolation of the nerve cells, and degeneration of the nuclei. A round-celled infiltration about the vessels was noted as well.

[Some years ago, Schede narrated a similar case in which symptoms of compression (fracture of arch of 6 D.) were relieved at once by laminectomy.—Ed.]

Cord. From A. J. Walton's[3] Hunterian lecture on surgery of the cord, we quote the section on *cases suit-*

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(2) Practitioner, September, 1919.
(3) Lancet, Feb. 15, 1919.

able for operation: In the early stages no operation should be undertaken unless there is some sign of recovery or the lesion is incomplete, in which case the earlier the operation the better. There may be an apparent exception. In certain cases presenting an irregular septic wound operative steps aiming at the excision of the wound and septic focus would be of considerable use in the prevention of meningitis. They would be instituted solely for the prevention of infection and not for the removal of pressure, but the full technic would, of course, include the removal of any missile or displaced bone.

Should symptoms develop later they will be due either to the collection of inflammatory exudates, to the contraction of scar tissue, or to excessive callus. In each they are directly due to pressure for the relief of which operation should be performed without delay. It may occasionally happen even with evidence of complete division of the cord the presence of severe root pains may make life unendurable, and since such cases may otherwise live in comparative comfort for 3 or more years an operation solely for the relief of this pain will be quite justifiable.

Operations repairing an injured cord either by suture or by grafting in other, usually heterogeneous, cord tissue, have been advocated but, unfortunately, the details given were so meagre as to be of but little value, and although great stress was laid upon the condition of the reflexes they would appear to be only those expected to be present in a cord recovering from shock after partial division. It should never, therefore, be advocated, for not only is it a distinct risk to life, a source of disappointment, but likely to bring laminectomy, for whatever cause, into considerable disrepute.

The treatment of the bladder *in gunshot wounds of the cord* is taken up by F. Kidd.[4] After such wounds, he observes, the bladder wall may suffer (1) overdistension and atony, and (2) cystitis and fibrosis, conditions which prevent the establishment of automatic bladder. He refers to a third class where the bladder has not been allowed to become overdistended and has been kept

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(4) British Med. Jour., April 5, 1919.

comparatively clean. Even in this class there are exceptions when there is profound toxemia from bedsores. In that case the cord does not sufficiently recover its tone to permit of "spreading reflexes," and consequent automatic flushing of the bladder.

If the bladder has been adequately treated what may happen after some weeks is—1. To begin with there is occasional and fitful evacuation of dirty residual urine. The catheter is still needed twice a day for lavage purposes. 3. Finally a regular automatic bladder is established, and the bladder empties itself partially or completely at regular intervals without a catheter. This automatic action can be reinforced by peripheral extravesical stimuli such as swabbing the penis, tickling the soles, or the anus, or the abdominal wall, or by deep breathing.

The length of time before automatic action can become established is—1. In partial lesions in 14 days or more. 2. In total lesions in 21 to 28 days. 3. In sacral lesions in 3 to 4 months.

Precautions needed to secure automatic bladder—1. In washing the bladder no pressure must be used which would overstretch the weakened musculature. 2. Severe cystitis must be avoided which would cause degeneration of the musculature and fibrosis of the wall. When a bladder has learnt to empty itself automatically at a certain size it can be made to act at a smaller size by "mass reflexes," tickling the skin of abdomen or deep breathing. Even in a lesion of the cauda equina an automatic bladder once established could be made to respond more easily by the use of these reflexes. Combined with the detrusor response to these reflexes there is also an inhibitory response to the tonic action of the sphincter when a catheter is not *in situ*.

P. N. Vellacott(5) also *discusses this aspect* after experience in 66 cases. He points out the very large number of deaths from ascending infections after catheterisation renders it essential to discover some other method in these cases of spinal injury. Retention is only a temporary phase, its average duration in the absence of infection being less than 3 weeks. The observations made on this series of cases leads him to conclude passive treatment—*i.e.*, allowing distension and overflow to take place—should be given a thorough trial, and that attempts at expression should be made from time to time. Assistance may be found in the administration of drugs, especially morphia, the application of heat, &c. When dribbling commences expression is usually quite easy and the bladder can be emptied partially at regular intervals. This diminishes the stretching of its walls and should allow its muscle to recover tone more rapidly. If complications (hemothorax, etc.) make it advisable to relieve the distension, temporary paralysis of the sphincter by instrumental stretching might be tried. Even moderate stretching renders expression a simpler and easier proceeding in the earlier and spasmodic stages of retention. It is of the greatest advantage that the treatment from the injury until the automatic stage is reached should remain in the hands of *one* person.

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(5) Lancet, May 3, 1919.

In a year at the Mayo Clinic, 17 laminectomies were *done for tumors*, and the end-results are narrated by A. W. Adson.[6] The removal of the tumor was effected in 8. Three patients have recovered; 2 improved greatly, 2 improved slightly, and 1 has a return; no deaths. In the 5 in which the tumors were not removed, 1 patient was greatly improved; 2 improved slightly, and 2 unimproved. One of the 3 patients with meningo-myelitis recovered, 1 did not improve, and 1 died. He believes neurologic examination is essential in all spastic paraplegias. If the patient presents sufficient signs of a cord tumor, he should be given the advantage of an exploration. A certain percentage of patients who have had tumors removed recover completely. A large percentage improve greatly. Although improvement is slight in some, an exploratory laminectomy is justified as one is unable to say, prior to operation, whether or not the tumor is removable.

THE UPPER EXTREMITY.

Removal of the entire arm and shoulder-girdle (Berger's operation) was done by J. W. G. Grant[7] in a man.

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(6) Minnesota Med., June, 1919.
(7) Lancet, Nov. 23, 1918.

of 43, for carcinoma starting in thumb, and for which several other operations lower down had been performed. A month later enlarged nodes were discovered in neck and removed, and 25 exposures to x-rays given. Six months after excision of nodes no recurrence.

In Berger's operation fat, glands, and muscles with their fascial lymphatic network are swept away in one piece, and this entails the minimum risk of cutting through infected tissues, and therefore fulfils the principal canon in the surgery of malignant disease. The cosmetic result (which, as a matter of fact, should not enter into consideration) is at least as good as in amputation at the shoulder, and retention of the shoulder-girdle is of no functional importance. In either case if an artificial limb is worn it is for appearance only.

As regards the steps of the operation, certain points are worthy of note: 1. A free removal of the clavicle facilitates finding the subclavian vessels, and also assists in securing the transverse cervical and suprascapular which may give considerable trouble. Le Conte disarticulates at the sternoclavicular joint for this reason, but one would imagine laying bare the great vessels at their emergence from the thorax, more dangerous. Chavasse divides both pectorals near chest, turns them out, and uses the ant. thoracic nerve as the guide to the axillary artery. By this means and dividing the serratus close to the ribs, and later the l. dorsi, the axilla can be removed with its contents intact. 2. Methods to diminish shock. Blocking by Crile's method each cord of the brachial plexus with 0.5 per cent. cocain as soon as they are exposed and before ligation of vessels is of great value. It might also be worth while to block the desc. branches of C. plexus by injecting them at their emergence on post. border of the s. mastoid. This would render the whole skin incision anesthetic.

3. Farabeuf's pectoro-axillary flap seems unduly full, and baggy flaps favor sepsis. With no anterior flap in this case there was abundant covering.

An extensive shell *wound of shoulder girdle* was treated conservatively with excellent results by H. C. Orrin.[8] It was impossible to bring the man in for

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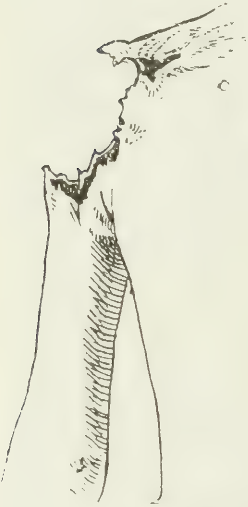
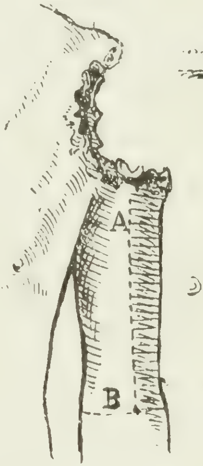
(8) Practitioner, March, 1919.

many hours, and he arrived practically moribund from hemorrhage and shock. After transfusion, examination showed outer end of clavicle, gone, with it acromion and $2/3$ of spine of scapula, muscles of supra- and infraspinous fossæ, glenoid cavity, head and upper sixth of humerus, the only structure left was coracoid. He reached England in 24 hours, and the arm was amputated at elbow, flap mapped out (diagram) along *A-B*. This was turned up and then rotated on itself so the inner border now became adjacent to the anterior and superior margins of wound, and was fashioned so as to follow accurately the sinuous outline of the shoulder defect; this was then retained in position by strong salmon-gut sutures. An excellent firm, fleshy, yet boneless stump was obtained. The coracoid was retained and proved of great use in fitting the artificial arm. Six months later the prosthetic apparatus was in good use.





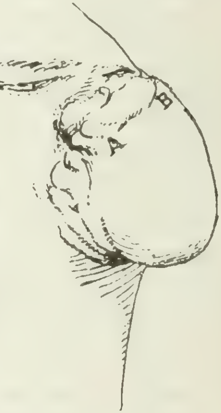


Fig. 158. View of wound from behind.
Fig. 159. Same from in front, with outline of flap.
Fig. 160. Same, appearance of stump (Orrin).

For over a decade, J. W. Dowden[9] has made use of the "*no-splint*" *treatment for fractures* about the shoulder, in humerus, and elbow, and points out its benefits:

The ordinary *fracture of the clavicle* is due, as a rule, to a fall on the point of shoulder. The resulting displacement of the outer fragment in is due to the force, and the downward and forward displacement to the weight of limb. The various bandages applied—Sayre's, etc.—are most excellent, when showing their advantages on a *sound* clavicle, but everything that is likely to approximate the shoulder nearer to the midline will most certainly increase the shortening, and that is what these applications do. Wharton Hood certainly made an advance when he only placed strips of adhesive over fracture. The first few days and nights, as in every fracture, are going to be unpleasant, splints or no splints, and the surgeon must try and arrange with pillows positions which will keep patient comfortable, together with the judicious use of heroin. In a few days the brain has become educated to appreciate there is a fracture, not only during the waking periods, but also during sleep, and the result is greatly increased comfort. By day, when patient is up, he goes about with a sling supporting the wrist slightly higher than elbow. He is encouraged to move his fingers and do what he can with them, carefully to pronate and supinate, flex and extend the forearm, and gently try to move his shoulder and arm. All these movements should be carried out *just short of pain.* It is surprising how rapidly improvement takes place, and patient can put arm into a coat sleeve. A few years ago a doctor arrived at Dowden's house with his arm bound to his side. He had had a motorcycle accident, and the doctor in England who fixed up his limb said —evidently deeply impressed by Lane's teaching—he must have it plated at once. Like many doctors, the patient was not anxious for operation, but was ready. As he did not object to some deformity and callus, so long as he had a perfectly useful arm, he carried out Dowden's treatment, and went back to work in 3 weeks' time, putting on coat himself and using his arm freely

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(9) **Edinburgh Med. Jour., December, 1919**

Fractures of the scapula are not common, but are treated in exactly the same way as those of clavicle, only in addition here passive movements, especially when fracture is near the glenoid, are carried out as well, never so far as to induce pain, but always with the endeavor to get more and more freedom.

All *fractures of humerus* are treated with the arm in a sling in a similar way. The only difference here is the application of a post. splint with a lower projection to the upper arm for the first few nights, much depending on the character of patient. The application is to prevent lying on the arm, and having a restless night and obvious distortion the next day, but, even if this does take place, the arm straightens out during the time he is going about. From the first Dowden encourages active movements of fingers and wrist, with pronation and supination, and tries to make patient flex and extend elbow a little. Massage in all is very helpful, and enables one to take more liberties with arm later. In 3 or 4 days passive motion assists greatly, lifting arm gently back and forth, and bending elbow as far as swelling and pain will permit. The most difficult position is complete elbow extension, and many do not attain it till 7th or 8th week. Patient should also practise these movements frequently, short of pain, but to increase the degree every day if he possibly can. No patient has had non-union, none had delayed union, except one who had to be confined by a ruptured kidney (and he was playing golf in 10 weeks). With simple fractures, all resumed work by 8th week.

Clavicle. The *barrel-stave splint* in fractured clavicle is warmly commended by H. A. Royster,[1] after use on 6 occasions. To apply, the center of stave is found, and this should be placed over the centre of manubrium, at the suprasternal notch. The stave is then sawed off at each end to fit just inside the head of each humerus while shoulders are drawn back, 1 in. from each end a nail is driven into, but not through, splint, then padded with cotton, retained by a bandage, and placed in the position as first mentioned, concave surface next to chest. While the splint is held in place and the shoulders kept

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(1) Annals of Surg., **October, 1919.**

firmly back, bandages are tied to the nails, carried under each axilla, and crossed on the back figure-of-8 fashion; as many turns are made and the stave is drawn as tightly as necessary. If there is a tendency of the splint to turn or to slip, adhesive may reinforce the bandage, but is rarely needed. If a heavy, muscular subject, the arm is put into a sling. Patient may use hands and forearms at will without disturbing the fragments, and is relieved of the distress which the older dressings give. (Plates XLVI, XLVII.)

Humerus. To overcome the usual difficulty in obtaining satisfactory *extension in fractures of humerus*, W. E. Tinley[2] had a splint made, on the principle of a lever corkscrew. By a double toggle in addition to the attachment at the fulcrum, the end of the lever, which is attached to the lower end of humerus, pulls in a straight line instead of through the arc of a circle as would happen if this toggle were not put in. The apparatus is attached to a Jones splint. A B is an aluminum plate fixed to the under portion of the forearm section of the Jones splint, H K a lever attached to this plate at the fulcrum C D, the double toggle being shown as B F E. The extension is fixed to the lower part of the arm by glued stockinette and the pull takes place from the lower end of it by means of tape attached to the lever at K, the direction of the pull being L K in the exact line of intact humerus. Extension is obtained by an elastic upward pull at H by rubber tubing over a vulcanite pad moulded to the lower end of the forearm or it can be attached to the sides of the Jones splint. In the sketch the extension is shown to extend far up the arm, whereas it is fixed to the lower end of the arm only, and the hand is shown in a position midway between pronation and supination, but in actual practice the hand is put up in full supination; these explanations are necessary as drawing is done to be as clear as possible.

According to J. H. Stevens[3] *fractures of the upper humerus*, *i. e.*, above the insertion of the pectoralis, will in nearly all cases conform to 3 types and their subdivisions. I.—Fracture of greater tuberosity without

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(2) Lancet, July 5, 1919.
(3) Annals of Surg., February, 1919.

displacement. Subdivision *A*—with displacement of the fragments. Both types may be complicated by subcoracoid dislocation. The shaft and neck are intact. II.—Fracture of the neck without displacement. Subdivision *A*—with displacement of fragments, the head, however, remains in the glenoid. Subdivision *B*—displacement of head from its relation with the shaft. The head is also dislocated. III.—Fracture of the neck with complicating fracture of the shaft.

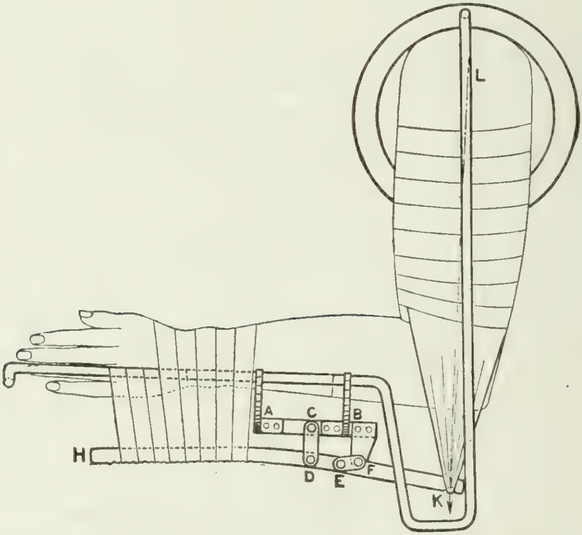
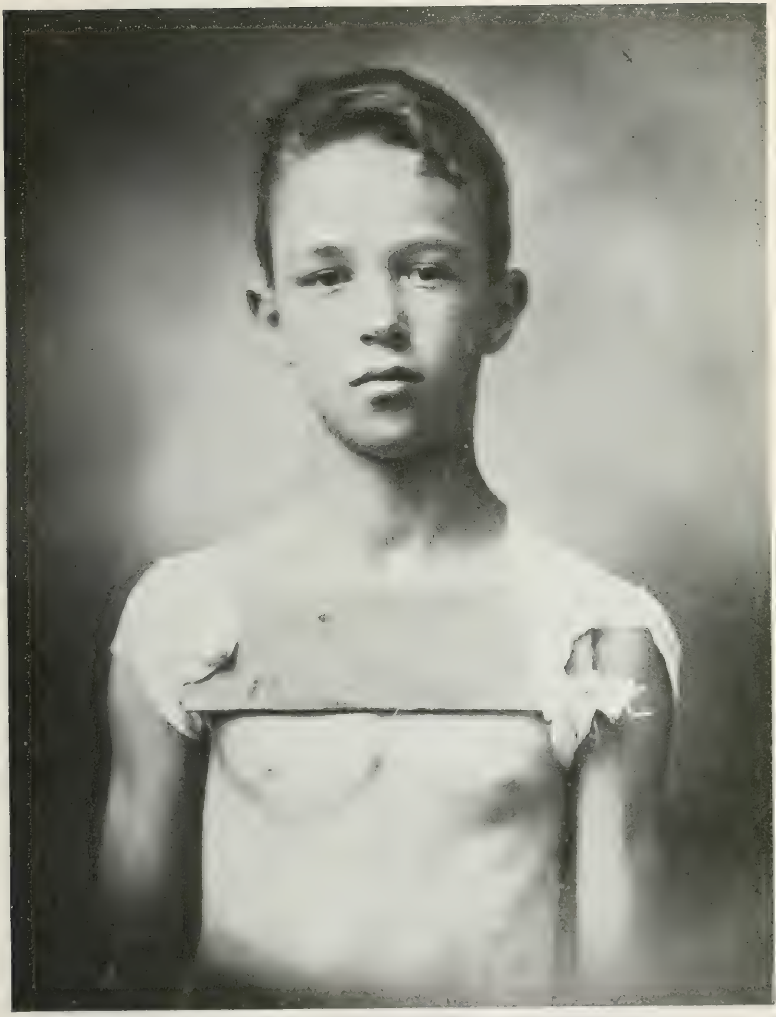


Fig. 161. Splint for extension in fracture of humerus (Tinley).

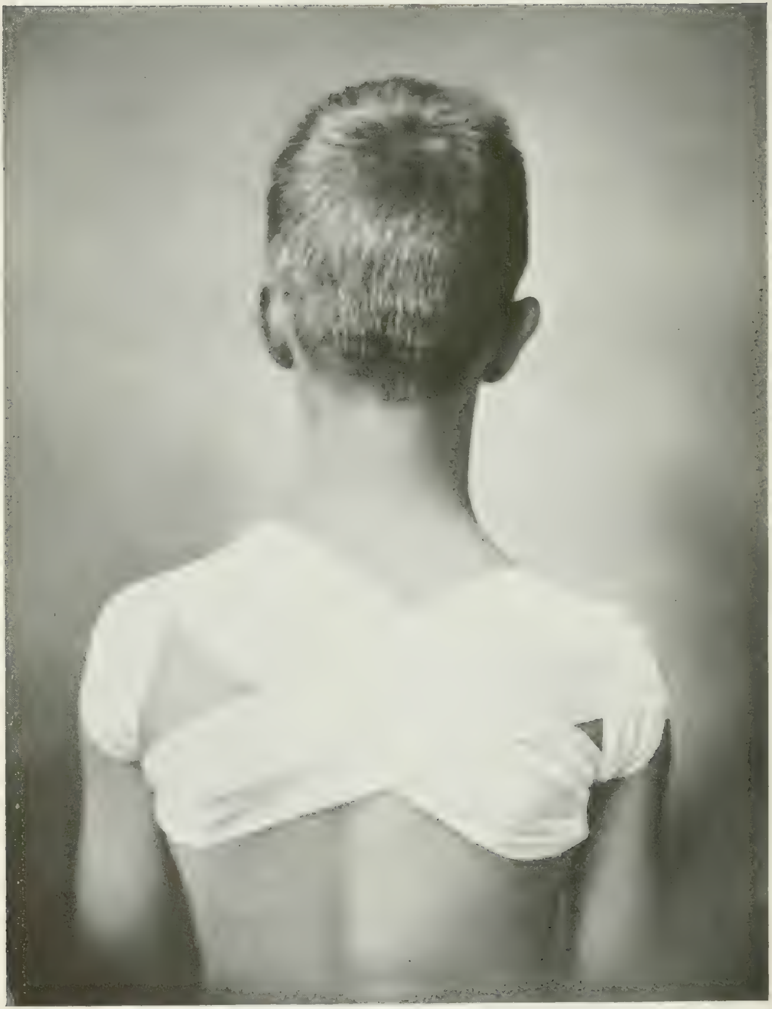
All should be treated in abduction and ext. rotation with traction from a few days in mild cases to 12 in complicated ones. Passive motion must be begun early and active motion must follow very quickly if we are to prevent restriction of motion. It must be used always with care and with due regard to the anatomy and pathology. In the mild cases it is safe to begin very early since there is little tendency toward displacement. A right-angled wooden splint in the severe

PLATE XLVI.

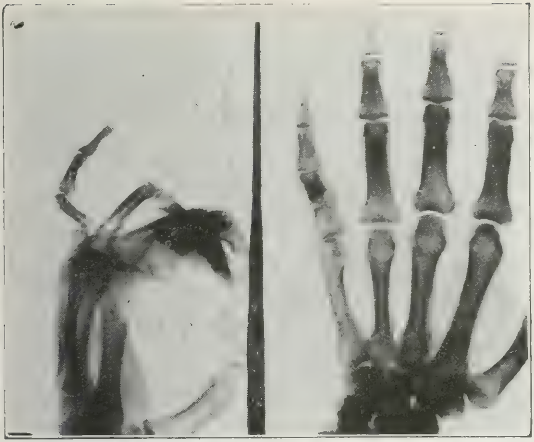


Barrelstave splint. Front view—padding purposely omitted. Royster. (See p. 558.)

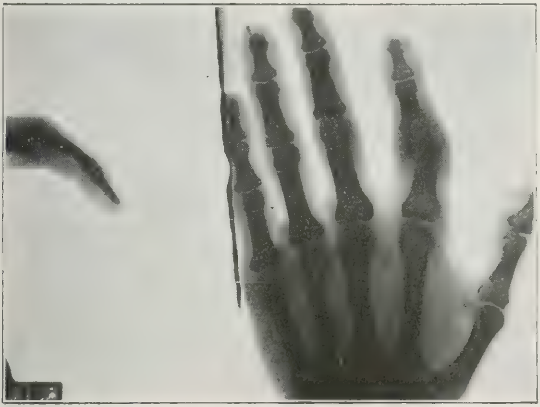
PLATE XLVII.



Same. Back view—showing figure-of-eight bandage.—Royster. (See p. 558.)

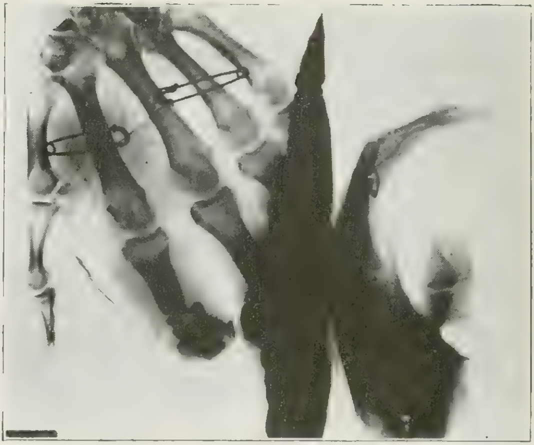


Finger fractures. Fracture of 1st phalanx of little finger in right hand of skilled machinist.

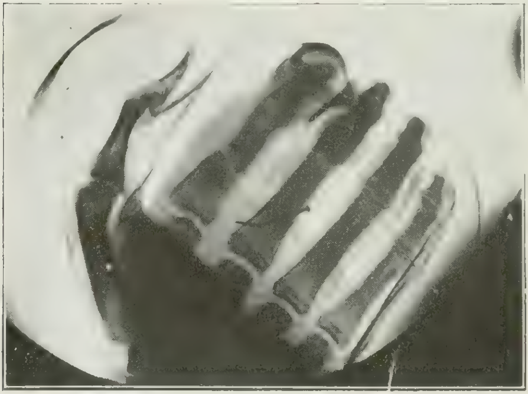


Fracture in 1st phalanx of right index of laborer. Hopkins. (See p. 566.)

PLATE XLIX.



Same. Wire loop through fracture holding in apposition.



Position of hand after operation. Hopkins. (See p. 566.)

cases and a firm pillow splint in the mild cases always with traction is the ideal treatment. Ext. rotation in abduction is almost an impossibility unless patient remains in bed. In bed it is the simplest method and not uncomfortable.

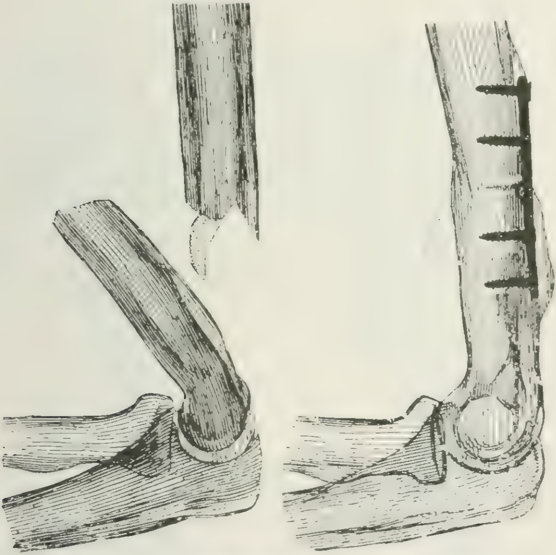


Fig. 162. Simple closed pseudarthrosis of humerus.
Fig. 163. Same after plating; consolidation in 48 days (Dujarier).

It is a good many years since the breaking of b. b. of the forearm called from the cause "chauffeur's fracture," was first referred to in the Surgery volume, (1910, p. 550). We are now introduced to another type "*propeller fracture*" from aeroplanes, as the pilot starts up the engine, the mechanic turning the propeller may be struck.

Of 4 cases seen by A. L. Johnson,[4] in all there was compound fracture of r. humerus 1 to 3 in. above epicondyles. There was a transverse lesion of the soft tissues at the plane of fracture, on the anteroexternal aspect.

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(4) Lancet, Feb. 22, 1919.

Considerable hemorrhage was present and great edema and ecchymosis. The treatment ran concurrently and the experience in all was uniform: 1. A straight Thomas' splint is useful during the first ten days to immobilise arm and facilitate treatment. 2. A right-angled Thomas' splint with extension is not suitable. 3. The classic treatment of putting the arm up in acute flexion is not suitable. 4. A Middeldorpf triangular splint admits of correct alignment of the fractured humerus, a satisfactory anatomic and functional result. It allows passive movement of the elbow during the treatment without disturbance of the fracture.

The end-results in 38 *pseudarthroses of humerus* are given by Ch. Dujarier:[5]

Operation.	No. of Cases.	Consolidation.	Failure Improvement Only.	Still Under Treatment.
Plate	16	8	5	3
Metallic suture	9	7	1	1
Clamp	2	2	..	..
Osteoperiosteal graft	10	8	2	..
None	1	..	..	1

For the humerus the per cent. of consolidation is 75.7, much less than for other bones where it is almost 90. The time required for consolidation was: One month, 3 cases; two months, 12; three months, 2; four months, 3; five months, 1; seven months, 1; ten months, 1; eleven months, 1; one year, 1.

Elbow. H. H. Skinner[6] gives the details of an interesting case of extensive shell wound of l. elbow, yet *with little nerve involvement.* The soldier was injured Nov. 1, and came under Skinner's care in this country, Feb. 24. The radiogram discloses the complete loss of both condyles of humerus, with a small attempt at callus formation anteriorly. Small pieces of shrapnel to be seen. The olecranon completely destroyed, together with both sigmoid cavities, leaving no cavity in which the radius may rotate. He found difficulty in rotating the radius, but was able to do so almost

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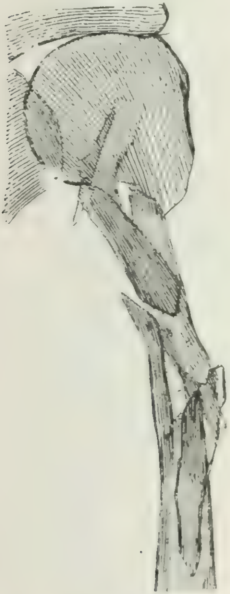
(5) Med. Record, Aug. 23, 1919.
(6) Northwest Med., May, 1919.

perfectly by holding upper ulna in r. hand. No damage whatever to radius. Although muscles, especially the extensors of forearm, are naturally attached to the condyles, still there are attachments in addition to the radius and ulna sufficient to permit functions. The only nervous disability at all seems to be the loss of sensation in 5th digit and most of 4th, due to disturbance of the functions of ulnar, the nerve most likely to suffer in such an injury.



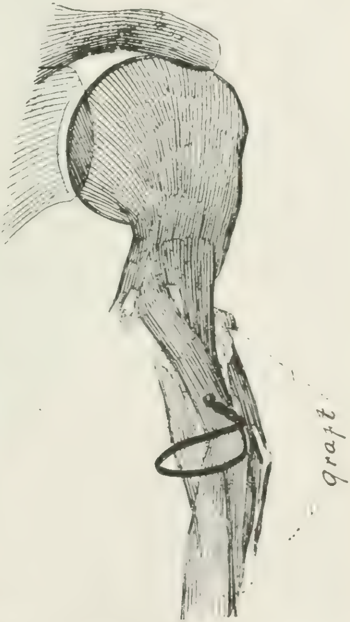


Fig. 164. **Pseudarthrosis of upper humerus.**

Fig. 165. Same treated by hooping and graft; union complete in 2 months (Dujarier).

Forearm. *Fractures of the head of radius* are believed by L. E. Daugherty[7] to be frequent and often unrecognized. The most common types are a split extending down into neck and shaft and a crushing of

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(7) Minnesota Med., September, 1919.

ant. lip. The cause is not definitely determined. The diagnosis can usually be made by the muscular spasm which accompanies rotation and this is present in all.

Some suggestions for *treatment of fractures of radius and ulna at the middle third,* are offered by C. H. Lemon.[7a] He knows he is taking issue with all the textbooks he has been able to examine when he urges and recommends the use of the supine position as opposed to the thumb-up and advocates the general use of plaster-of-paris in treating these cases, doubly reinforced at the point of fracture and over-corrected, *i. e.,* slightly bowed in the direction of extension to the thickness of the plaster-of-paris, over the site of the fracture. Plaster-of-paris should not be used in the treatment of these cases as a primary dressing. It will lead to disaster. For the first 4 or 5 days during which the swelling will reach its height, ordinary coaptation splints may be used, the point opposite the fracture being doubly padded to produce over-correction, and for this primary dressing it is not necessary in his experience to use a splint which extends beyond the elbow joint, but at the end of 5 days, when the swelling is absolutely under control and has usually begun to recede, to treat these cases with a splint or any form of apparatus which does not extend above the elbow joint up to the arm to at least one-third of its length, is to be guilty of gross error. Many of these fractures occurring at the middle of forearm are subperiosteal fractures, rather than green stick fractures, and no displacement of the fractured ends occurs either laterally or anteroposteriorly. They are, therefore, comparatively easy to reduce. In many but little swelling in the forearm occurs and we are misled to believe that at the primary dressing a plaster-of-paris bandage extending above the elbow is the proper primary treatment. If this is used, it should be removed not later than 2 weeks after it is applied, notwithstanding the fact that an *x*-ray taken through the cast after it is applied shows an absolute alignment in both planes. On account of the pliability of the soft parts of the arm and forearm, just enough shrinkage

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(7a) Wisconsin Med. Jour., April, 1920.

will occur in the average child to permit of the bowstring contracture of the flexors and pronators.

Four points in *treatment of Colles' fracture* are emphasized by D. Eve, Jr.,[8]: (1) Always insist on an anesthetic to reduce the fracture. (2) Do not immobilize the fingers. (3) As a rule, remove the splint or splints in 3 weeks' time, and—(4) If the patient continues to suffer a great deal of pain for 2 or 3 days after reduction, the fracture has not been reduced.

Hand. In a man, of 25, an *angioma of palm* necessitated amputation by Sir J. Bland-Sutton.[9] The man said the swelling had existed as long as he could remember, but the vessels had of late increased in size. As he could use his hand and fingers freely Sutton did not feel disposed to intervene, but warned him to return on the appearance of any serious change. Six months later he came back in a pitiable condition, ill and suffering. The 4th and 5th fingers were gangrenous and bleeding. Amputation just below deltoid insertion.

As soon as removed the vessels were injected with wax and dissected. The brachial, more than twice the normal size, divides at elbow into ulnar and radial; each as big as common femoral. The ulnar, the larger, runs its normal course, and forms a superficial palmar arch consisting of a big moniliform artery sending branches to feed a cavernous angioma in the skin of palm. Superficial veins arose from the angioma and passed up forearm as usual, but were unusually big. Through this communication much of the injection material reached the veins. The radial ran a normal course, but formed a tortuous rete mainly in 1st interosseous space. Several large veins arose in this plexus. The interosseous arteries in forearm are larger than usual, and the superficial palmar arch does not join the radial in 1st space. The venæ comites not enlarged. All the vessels supplying and discharging blood from the angioma had walls of same thickness. They buzzed or purred with the same note and thrilled equally. The big angioma exercised the same effect on them as a varicose aneurism. The blood was of same color in the arteries as in veins; not so

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(8) Railway Surg. Jour., February, 1919.
(9) British Med. Jour., Nov. 30, 1918.

bright as arterial blood, nor so blue as is usual in the superficial veins of forearm. The veins and arteries alike in structure; no sharp distinction between the coats and elastic tissue is deficient in quantity.

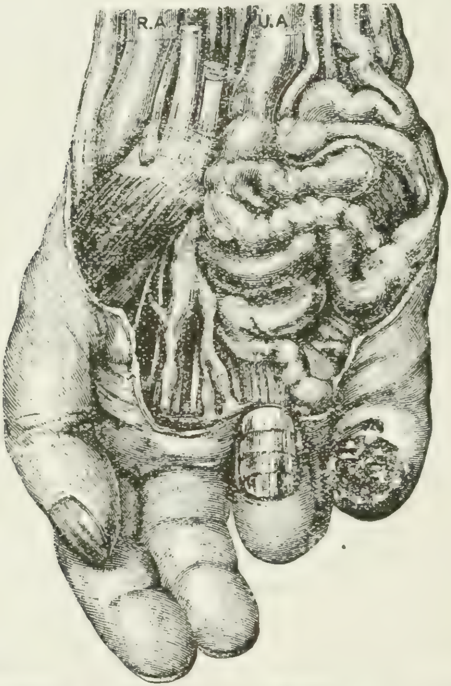

Fig. 166. Large cavernous angioma of palm. *R.A.*, radial artery; *U.A.*, ulnar. The impaired nutrition is shown by ridges on nail (Bland-Sutton).

The much-neglected finger fracture is considered by C. W. Hopkins[2] who as chief surgeon of a large railway system has had unusual opportunities for seeing the poor results often obtained. Most of the fractures that are followed with deformities occur in the proximal phalanx. A lesser number occur in the middle one, and occasionally one in the distal phalanx. If this is so, would there not seem to be a good reason for it?

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(2) Railway Surg. Jour., January, 1919.

Slides of 4 cases were shown. All of these fingers had been placed upon a short, straight splint, no skiagrams had been taken before or after reduction and dressing, nor after splints were removed. All of the men had been off duty for a long time, endeavoring to restore the finger to its normal function, and had been told by their surgeons the slight deformity or hump was due to callus formation and that time would gradually restore the finger to its normal usefulness. They had all returned to duty, but on account of lack of function and increasing pain, had been compelled again to lay off and seek assistance, expecting that the fingers would have to be removed to enable them to resume vocations.

Before dressings of any kind have been applied, or any attempts at reduction been made, skiagrams in both directions should always be taken to ascertain the character and location of the fracture, as many times comminution will be found, which could not have been demonstrated otherwise. After this is done, the hand should be placed upon a well-padded roller bandage splint, long enough to reach across the palm, so all the fingers can be immobilized for the purpose of acting as lateral splints to secure the proper position of injured finger. The splint should be first well fixed in the palm by wide adhesive strips placed lengthwise and carried over the dorsum of hand. The fractured finger should then be strongly flexed around splint with an adhesive strip passing from the wrist, forward over the injured finger and splint and well back upon forearm. The other fingers should then be immobilized in the same manner, especial care being used to see all are in normal line with relation to each other, as otherwise there may be some lateral angulation at the fracture. The hand and fingers then to be well dusted with powdered boric acid or some other good dusting powder, with strips of gauze or cotton between fingers to prevent maceration. The entire hand and wrist should then be padded with cotton and dressed with a well-fitting roller bandage. (The thumb may be left free if uninjured.) The dressing should be allowed to remain, undisturbed, for at least 2 weeks when it can be carefully removed, the skin cleansed and the other fingers manipulated and massaged, the same kind of dressing then reapplied for another week and again removed and mild passive motion made of injured finger. At the end of 4th week all dressing usually can be removed entirely, the hand used with care for another week. In practically all cases of this kind, such treatment will bring about a perfect result, allowing return to work at the end of 6th week. This will be about 1 or 2 weeks longer than for a fracture of the middle or distal phalanx.

The middle phalanx should be dressed with either a straight palmar or dorsal splint, but the mistake must not be made of having the splint merely the length of the finger, allowing the hand to be used during healing, but carried well back and fixed at the wrist with adhesive which should also be carried around hand. After this fixation at wrist and hand, sufficient extension can be made and the finger immobilized by passing wide adhesive strips above and below fracture, the finger well padded and dressed with a bandage. The usual straight splint, if proper reduction is made, is all necessary for distal phalanx.

Unfortunately the deformity is not discovered until all splints have been removed and prolonged effort made to re-establish function, by which time the callus is firm and it is too late for refracture by ordinary means. These fingers can be restored to their normal position and function by a very simple, but delicate operation. It should always be done under general anesthesia as there must be absolute relaxation with not the slightest degree of resistance by tendon contractures. An incision is made on each side of proximal phalanx along its entire length, the tendons lifted and wide strips of tape carried under them and held by one assistant, thus keeping them out of field. The hand is then turned so as to rest upon the ulnar side, the other fingers completely flexed and held by a bandage. A tight roller on end, is then placed under finger, which is to be operated upon, giving support immediately under fractured phalanx. The deformity can readily be felt and seen and the fragments separated at the point of union with a narrow artist's chisel, tapping with a light hammer. The ends are then freshened and drilled, passing a loop of fine silver wire, kangaroo tendon, or heavy catgut through the drill holes, and the freshened ends drawn together in proper alignment. The tendons are then dropped back into place and the skin sutured with fine catgut. A roller bandage splint dressing should then be applied as in a recent fracture. As the loop is only necessary to hold the fragments in line while the dressing is being applied, Hopkins is now using, in most cases, heavy catgut. This will absorb and minimize the possibility of having to remove it later. The dressing should remain in place at least 4 or 5 weeks without being disturbed, as it necessarily takes longer for the second union to become firm, on account of the lack of normal blood supply and lowered tone of the soft parts, and always a degree of osteoporosis, due to the long disuse following initial injury. (Plates XLVIII, XLIX.)

Occasionally the marked osteoporosis will cause a complete failure of union and the finger has to be amputated, but even then the patient is relieved of a troublesome finger and no worse off than before.

Harbaugh, Helsley and Hensley[3] point out the unsatisfactory results from *finger injuries in industrial accidents,* with special reference to amputations. Of 4,265 permanent injuries (California) in 1914-6, over half (2,437) involved the fingers, by finger amputations, 1,946 occurred in the three years, and only 189 amputations of arms, hands, legs or feet. Approximately 200 noninfected finger injuries were seen. Practically all these were the results of accidents in 1915-6, in a district comprising roughly the northern part of state. Unsatisfactory results were noted in 96 of these cases.

They believe from their investigations that to avoid an oversensitive stump a good pad of soft tissue should overlie the bone end. The position of the scar is less important than the question whether it is adherent to the bone (associated with insufficient pad), or has a nerve end caught in it. Wherever possible, severed nerves should be shortened to avoid inclusion of the end in the cicatrix. The possibility of a troublesome deformed nail should be considered where the damage to the soft parts extends as far proximally as the distal joint, and a de-

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(3) California State Jour. of Med., August, 1919.

fective nail may still appear in amputation through middle phalanx, depending on the size of dorsal flap. Such nails are a nuisance and should be avoided by removal of the entire matrix.

A finger "rebuilt" after severe damage is more than likely to be a nuisance to a laborer. Assurance must be had of blood and nerve supply sufficient to maintain normal vitality. Otherwise amputation is preferable. Dependent somewhat on the occupation, a stiff finger usually impairs the function of hand. If the adjacent finger is also injured severely, it is more often advisable to save a severely damaged finger. Amputation flaps should be neatly constructed and bone carefully inspected for irregularities or loose fragments. It is usually better to do all operative work at once rather than wait for later developments. The surgeon should remember a laborer's hand is going to be used to work with, and should, when possible, adapt the result to the occupation. Stumps of fingers amputated at the middle joint or through proximal phalanx are mobile, and good function is the rule.

THE LOWER EXTREMITY.

Pelvis. H. Schiller[4] was called to see a man, of 30, with *rupture of symphysis.* The cause was a fall from window down one story striking r. buttock. Stunned by the fall he recuperated quickly and crawled through the window and went home, walking from the taxi to his room and climbed up 8 steps assisted by one man. Seen 2 hours later, complaining of pain in the region of both sacroiliac joints, radiating into legs, also of pain in region of symphysis, and when trying to use legs; however, he was able to do so. A wide gap between the pubic bones, easily admitting finger, could be felt and the man was sent to hospital. Next day a large hematoma over tuber ischii, bluish discoloration of penis and upper scrotum could be seen. The patient could not urinate and had considerable meteorism and nausea. He complained of pain in the back and tenesmus. An adhesive strap brought bones into good apposition and after 3

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(4) Illinois Med. Jour., February, 1919.

weeks man could walk comfortably with no lameness. Meteorism and retention disappeared in 4 days.

Another case, operated on by E. W. Buckley,[5] also in a man, was due to his horse falling on him. Here in addition to the separated symphysis, there was fracture of pubic ramus and rupture of bladder. After an auto trip of 40 miles he reached hospital in good condition and was operated on about 9 hours after injury. Separation at symphysis of .5 in., r. ramus broken into obturator f., and tear in bladder admitting gloved index. Excellent recovery in due time.

J. M. Jorge, Jr.,[6] relates a case of symmetric *tuberculous fistulas in the pubis* as the only appreciable manifestation of the disease. The patient was a girl of 8, weighing 46 lbs. The fistulas healed at a seashore sanatorium and the child weighed 77 lbs. when definitely cured. Jorge has been able to find but 60 cases of tuberculous lesions in the pubis, and as a rule the lesion was the only manifestation of the disease except when merely an extension of hip joint disease. The pain usually is not severe, and it comes on after exercise, but extremely painful points can be discovered in the pubis. Even after apparently complete cure, the focus may flare up again many years later, especially after a pregnancy, or without apparent motive in strong and robust men. In his case the abscesses kept suppurating after 6 months of general treatment, heliotherapy, etc., and 3 of bismuth paste or other local measures. Then he curetted the foci in bone, and this started local repair.

Buttock. The occurrence of *glioma* outside the central nervous system is very rare, yet A. R. Kimpton[7] had the good fortune to come across 2 cases in boy- and girl-babies, each 14 weeks old. Both were operated on, in the boy 4 years later there was no evidence of recurrence. The other child died on 3d day from pneumonia.

[Another instance of the tendency alluded to by Newman (Kidney) for uncommon cases to be met with in small groups.—Ed.]

Hip. A rare injury, *central dislocation of the femur*

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(5) Med. Jour. Australia, May 24, 1919.

(6) Revista Asoc. Méd. Argentina (quoted in Jour. Amer. Med. Ass'n., Aug. 16, 1919).

(7) Annals of Surg., November, 1919.

with fracture of acetabulum, occurred in a man, of 48, under the observation of M. M. Peet.[8] The cause was a fall of 8 ft. on May 29, striking r. hip. Considerable bleeding from bladder and urethra. The leg was held in abduction at an angle of about 45°, Buck's extension applied, giving a direct pull in this direction, and the foot of bed elevated to give counter-traction. A second extension was placed around the thigh, close to groin, and lateral traction made. On the 16th day the extension had to be removed because of bed-sores and was not reapplied. There had been no evidence of any reduction in the dislocation, and the condition had not warranted any manipulative measures.

Under ether, July 7, Peet manipulated the hip in all directions with evident separation of adhesions. The femur was rather strongly fixed, but many adhesions could be felt giving way and the leg could be moved freely in all directions. It was impossible to extract the head of the femur from pelvis with a safe amount of force. After manipulation the shortening previously noted had disappeared.

Discharged, on crutches, July 13, with free passive motion in all directions, limited active motion because of some tenderness in hip, and with normally functioning urethra. He was advised to keep up both active and passive movements and not to bear weight on leg for 3 months. A letter the following January reported he was walking without trouble and the urethra was still functioning properly.

[For other central dislocations see Vaughan's article (1913 volume, p. 575), and especially Schroeder's (1910, p. 564), the latter having had 3 cases under treatment. This is further proof—if any were needed—of Newman's observation about rare conditions tending to occur close together.—Ed.]

The only simple intracapsular fracture seen *in a child* by Sir J. Bland-Sutton[9] was in a boy, of 12. While at play had acute pain in hip. A few days later he was admitted, and an *x*-ray showed clearly an intracapsular fracture. The boy made a good recovery, and walks

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(8) Annals of Surg., September, 1919.
(9) Lancet, Nov. 30, 1918.

with a limp, which is disappearing under massage and judicious exercise.

When rearranging the hospital museum (1883) Sutton found the upper half of a femur with an intracapsular fracture of its neck. It clearly belonged to an individual of about 15, for the epiphyses are ununited (illustration). Senile femurs with broken necks abound, but he doubts if 5 examples from boys or girls exist in all the museums of the United Kingdom.

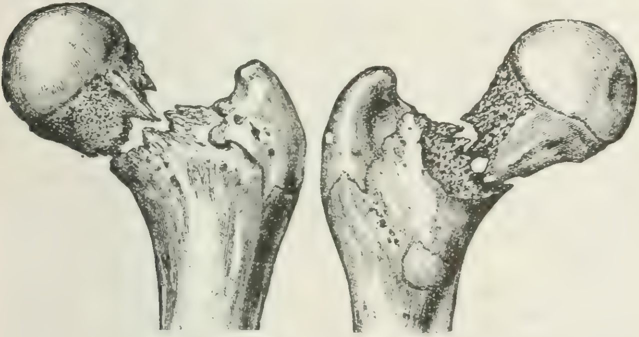

Fig. 167. Intracapsular fracture (Museum specimen).
Fig. 168. Same, posterior view (Bland-Sutton).

D. M. Greig[1] *corroborates Sutton's opinion* as to infrequency, and gives the reasons: This fracture is not common, and it is not fatal. Indeed it is to radiographic collections and not to museums, that one must look for even the existence of this fracture. The possibility of fracture of the neck of the femur in children was not overlooked altogether by the older writers, but they were misled by the absence of crepitus, and where injury was admitted it seems to have been considered a separation at the epiphysis, if displacement took place. In this respect radiography has also altered our opinions to some extent in that in many cases where, clinically, a separation at an epiphysis is diagnosed, radiography shows there is really a fracture close to epiphyseal line.

Fracture of the femur is vastly more common in chil-

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(1) Edinburgh Med. Jour., February, 1919.

dren than in adults. Out of 310 consecutive cases of which Greig has notes, 193 occurred below 10 years and 34 between 10 and 20. All the other ages from 20 up only yielded 83 cases. But when fractures of the neck are considered the relative frequency is reversed. Three cases occur below 20, none between 20 and 30, only one between 30 and 40, while over that age no less than 35 are fracture of the neck.

The three under 20 were girl, 2; boy, 2; girl, 15. In cases 2 and 3, the accident was recent and the salient symptoms were lameness and pain. No displacement at hip nor eversion of limb, and no crepitus. In No. 2 displacement had doubtless followed attempts to make child bear its weight on hip. The absence of the characteristic signs usual in adults must be accounted for by the physical differences between the periosteum of infancy and age, the relative difference of the weight and size of the lower limb to the trunk in children, and the ease with which a child can be moved and transported.

Thigh. J. W. Sever[2] considers *fracture of the neck of femur*, based on 40 cases, of these 21 are those involving one or both trochanters, and the so-called subcapital type where the fracture is located near the base of the head at its junction with the neck. Both types require treatment, not radically different and apart from old age, obesity, and general weakness, essential to a result which should be better than is usual.

In looking at the results, there are only 9 which could be classed as good or fair; *i.e.*, these people have legs which they can walk about on and do their work without great discomfort or limp. This is approximately 23 per cent. Five were sub-capital fractures and 4 were of the intertrochanteric type. Of the sub-capital type, 1 was treated by sand bags, 1 with Buck's extension and 3 by Whitman's method. Of the intertrochanteric type, 1 was treated by Buck's extension and later with a plaster spica, and 3 with sand bags alone. The average age was 61, the youngest 14 and oldest 88. Three cases of sub-capital fracture in this series were forcibly impacted by Cotton by his method and the results are

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(2) Boston Med. and Surg. Jour., Jan. 9, 1919.

known in 2. They are not classified in the 9 known good results.

C. Davison[3] states autoplastic transplants are of value in 3 types of *defects of the head and neck of femur*, but patient must be vigorous enough to withstand operation, and young enough, as an economic possibility, to warrant the attending discomforts and dangers and the expense of time and effort required.

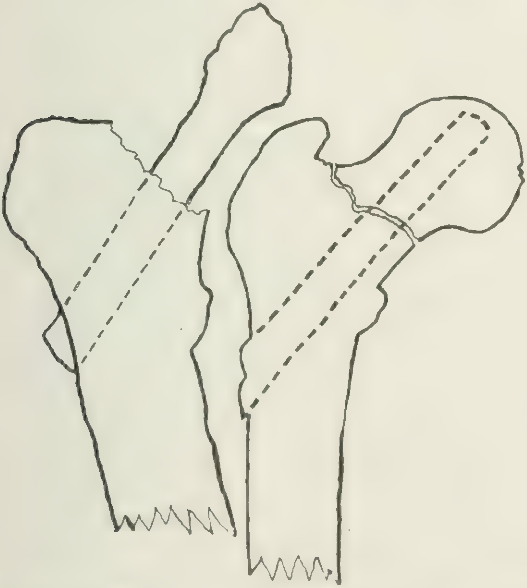

Fig. 169. Transplant of upper fibula to remedy loss of head and neck of femur.

Fig. 170. Transplant of segment of fibula across fractured neck of femur at angle of 135° with shaft (Davison).

I. Recent fracture of the neck without impaction may be repaired by grafting a segment of fibula across the line of fracture. To obtain ideal results the repair should be performed early before the vitality has been disturbed by lessening of blood supply. Under favorable

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(3) Surg., Gynecol. and Obstet., August, 1919.

conditions the union of fracture resembles healing of wounds by primary intention and without doubt the capital fragment retains its integrity and persists as a vital portion of the femur. II. Ununited fracture of the neck with diminished vitality of the capital fragment may be repaired by transplanting a segment of fibula across the non-union. Under favorable conditions the transplant grafts to the lower fragment in a manner similar to that in recent fractures. In the capital fragment the process is different. It simulates healing by granulation. There is a stimulation of osteogenesis by the transplant with projection of new bone cells into the devitalized fragment which acts only as a frame-work for the deposition of new bone. The old bone is gradually absorbed as it is replaced by new bone. Under the stimulus of the transplant, new bone is deposited in and around the area of the nonunion, until the old fracture is obliterated. Later both the transplant and the new bone are absorbed and modified until there is compensation between elasticity, strength, and function. III. The head, destroyed by injury or disease, may be replaced and fair function re-established by transplantation of the head and upper fibula into the upper end of femur so the articular surface of the fibula will articulate with the acetabulum. Under favorable conditions the transplant will graft to the shaft of the femur. The part of the transplant which replaces the head and neck of femur, will hypertrophy until its size and strength are sufficient to meet the functional demands.

In addition to the details (Asepsis and Antisepsis) as to treatment of wounds by German army surgeons, M. Sinclair[4] furnishes some about *fractures of the femur*. They were obtained from 41 repatriated prisoners and interrogation of these, both officers and men, shows on the whole they were kindly treated, that the lack of food which often obtained was not the fault of the surgeons, and that in many cases they tried to the limit of their ability to get the patients better. As evidence of the fact the surgeon took trouble in treating, the patient, one officer, who was wounded in March, 1918, states the professor 5 times re-fractured his leg and set it again.

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(4) Lancet, March 29, 1919.

The guiding principles would seem to have been lack of extension and indefinitely prolonged immobilisation. The majority were treated on a trough-like metal back-splint with foot-piece, the splint being of the same length in every case. It was the wounded man's misfortune if he received no posterior support to his fracture, and due entirely to the fact he had been so misguided as to incur a fracture higher on his thigh than the splint would reach to. Apparently the continuation of hostilities was sufficient indication to persevere with this immobilisation without extension, as the patients wounded in March were, when released, still in the same state of splinting as those whose legs were broken in October. One enthusiast apparently tried an original method of extension on some of the cases. A sharp-pointed rigid metal hook, shaped somewhat like a note of interrogation, was put into the anterior surface of the tibia, with its straight unpointed end lying in the long axis of the bone and directed towards the foot. Another of these hooks was passed in the opposite direction through the superior spine of ilium. A rope over a pulley with a brick at the end was attached to each hook for extension. A patient treated in this manner stated every time his posterior wounds were dressed the weights were removed and he then noticed grating of the bones and shortening of the limb. In another case the hook in the anterior spine tore out and caused death some days later from peritonitis.

Sinclair gives some typical radiograms taken after the patients reached him: (1) Very marked abduction of the upper fragment in a fracture at the junction of the upper and middle thirds. There is union with very marked angulation at the fracture and consequent shortening of 6.4 in. The upper end of lower fragment is through the skin of thigh (2 and 3) the antero-posterior and lateral views of a patient who in March, 1918, sustained a compound fracture of the middle of femur. The bones are overlapping and limb is 6.8 in. short. The knee is absolutely stiff and there is apparently fibrous organization between the pieces of bone, as the limb is quite flail in the midthigh.

In 131 *fractures of femur* treated at American Red

Cross Hospital No. 2 (Paris), there were—so Bulkley and Sinclair[5] inform us—26 deaths. Of the early deaths, 7 were due to gas gangrene, and 2 to associated secondary hemorrhage; practically all late deaths to streptococcus.

They conclude a compound fracture should be operated upon and held for a month, or immediately transported without operation to a hospital where definitive treatment can be carried out. It is an injury of war whose mortality rate is high and late results often crippling. It is an injury to which a sufficient amount of attention is not paid, possibly because often associated at first with relatively small wounds which to the unpracticed eye do not forebode serious results. But it is from these wounds, no matter how small, that the danger arises. Closed fractures are not of particular danger. Given an associated local wound of the soft part, and the prognosis becomes immediately worse. And given a combination with an inexperienced surgeon doing inexperienced surgery and an inexperienced "triage" officer indiscriminately evacuating the cases, and the prognosis becomes distinctly bad.

The chief danger lies in gas gangrene early and streptococcus later. Both can be best combated by early, adequate, and radical surgery. Bullet fractures are practically as dangerous as are those by shell fragments. The occasional bullet wound may be observed without operation, the shell wound never. Those fractures splitting into the hip- or knee-joints are infinitely more dangerous than those involving only the intermediate portions of the bone. Those involving the hip should probably always be amputated and then disarticulated. The majority of those of knee will need resection or amputation. The primary operative procedure should be radical to the point of apparent brutality. They have never seen too large an incision, have seen many pitifully inadequate ones. Amputation should be done oftener and earlier. Too many attempts are made with results disastrous to life to save worthless limbs. The ideal form of traction is skeletal, and practically without danger. Femoral is superior to tibial traction.

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(5) Annals of Surg., May, 1919.

If more care were paid to operative treatment, chemical treatment of wounds would be unnecessary.

The *ext. iliac was successfully tied* by C. E. Davidson[6] in a boy, of 15, who fell on a pitchfork puncturing the vessel in front and about midway. Silk used for ligature. Last seen 3½ months later, walking well and in good condition.

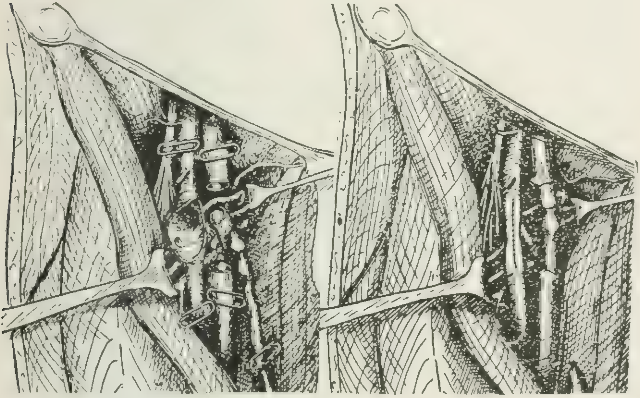

Fig. 171. Condition of vessels confronting for repair. Through the opening in femoral artery can be seen the mouth of profunda artery. The cut ends of saphenous, profunda and femoral veins can be seen.

Fig. 172. Completion of suture, showing graft of internal saphenous with two valves into gap in femoral vein; lumen of femoral veins narrowed by suture for end to end suture with graft; lateral suture of femoral artery, and ligation of profunda vein (Bunnell).

An *arteriovenous aneurism of femoral* at junction with profunda was repaired by S. Bunnell.[7] The soldier, 4 weeks previously had been shot by a machine gun bullet, which entered thigh, passed through artery and vein, then through the pubic bone, bladder, and on out through l. buttock. For a few weeks the urine escaped through buttock, and then fistula closed. After suture of artery which lessened the diameter to a little over half the normal, a segment of int. saphenous v., 2 in. long, was grafted between ends of femoral. At the completion of the operation, the leg was somewhat

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(6) Jour. Amer. Med. Ass'n., July 26, 1919.
(7) Ibid., Sept. 20, 1919.

cyanotic from the long time the vessels were clamped. A pulse could be felt distal to the part repaired.

In an hour the cyanosis cleared, and from then on the temperature, color and appearance of legs were equal. The thrill and bruit were gone, and did not reappear. The pulse could not, at first, be felt in d. pedis. This was evidently because wave was interrupted by the narrowing at the suture line, as in a week the artery, having had time to dilate, the pulse in d. pedis made its appearance and remained present. In 3 weeks was allowed to go about, and leg gave no trouble. In a letter 5 months later, stated he had had no circulatory trouble; that he had a complete absence of such symptoms as cramps, coldness, weakness, heavy feeling or pain. As an additional test, an open wound, through dorsum of foot, healed soon after operation.

[In this operation Bunnell used his ''vessel-support'' shown in the 1911 volume, p. 171.—Ed.]

The tendency of the majority of surgeons in selecting the *level at which to amputate in arteriosclerotic gangrene* is to be guided by the extent of the area of gangrene. Not infrequently, the amputation is followed by extensive sloughing of the flaps and either death follows from sepsis, or, as in a case recently observed by them, the opposite limb becomes involved by extension of the thrombosis from the femoral to the iliac and then across to the opposite iliac artery. Eisendrath and Bettman[8] have felt the ideal method of choosing the level at which to amputate would be to expose the femoral at the middle of the thigh and to follow it up or down direction until a level was reached at which the thrombotic occlusion ceased, and distinct pulsation could be observed. They have pursued this plan in a recent case with very gratifying results:

A man, aged 56, was admitted with marked arteriosclerosis and an area of gangrene involving the entire dorsum of foot. There was no pulsation as high up as the upper femoral region. An amputation through the lower third (Gritti-Stokes) was decided on. On exposure of the femoral vessels at middle of thigh for pre-

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(8) Jour. Amer. Med. Ass'n., Dec. 6, 1919.

liminary ligation, the femoral artery was found occluded by a thrombus. Following the vessel upward direction they were unable to find any pulsation until close to Poupart's ligament. At this level, the artery was ligated just above the occlusion, *i. e.*, through the lowermost pulsating portion. Amputation at this level, and the patient, extremely septic, made an uneventful recovery. In spite, however, of the high level of the amputation, there was moderate gangrene of the skin flaps. Dissection of the limb revealed many calcareous areas in the femoral and a firm clot completely occluding its lumen up close to the femoral canal. It was firmly adherent to the intima in many places and extended from the femoral into both tibials. The veins were normal.

Commenting on this, L. B. Meyer[9] observes the surgeon frequently feels that whatever may have been the level he has chosen, he has erred. If he obtains primary union without gangrene of the flaps, he wonders if possibly he has not made his amputation too high; and if gangrene results, he thinks he should have amputated higher.

In an amputation below the hip, a few in. more or less of stump is of extreme importance. It is generally conceded that amputation higher than 3 in. below great trochanter is almost worse than useless from the standpoint of hip motion of an artificial limb, so the surgeon should make a strenuous effort to get a stump of satisfactory length. He has amputated in midthigh, and been compelled to reamputate a few in. because gangrene of the flaps did not leave sufficient skin to cover over exposed bone; but even after the secondary operation, the length of stump was satisfactory. Sight is lost of the fact this is a chronic condition affecting chiefly main trunks and their terminal branches, and a fair collateral circulation is established before the patient is operated on. Were this not so there would frequently be complete gangrene of leg, something Meyer has never seen. The superficial femoral and the ant. and post. tibials, are often occluded, the deep femoral rarely. It is this artery with its branches that will usually take care of the nourishment of a fair sized

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(9) Ibid., Jan. 24, 1920.

thigh stump. He believes had the amputation in Eisendrath's case been a few in. lower, leaving the profunda (which in the diagram is free of thrombus) to take care of the circulation, no gangrene would have occurred, and the patient would have had a serviceable stump, which today he probably has not; even if some gangrene had occurred, the amount to be sacrificed in a reamputation might still have been so small the final result would have been good.

F. C. Watson[1] removed a *large angiolipofibroma* from the thigh of a negress, aged 67. First noticed 10 years previous, it gradually but progressively increased.

Locomotion was quite difficult. There was never any pain nor tenderness associated. The general health remained excellent. Examination revealed a soft, doughy mass reaching from about 6 in. below groin to a little below knee. An elliptical incision was made over tumor, removing a portion of the redundant skin and subcutaneous tissues. Enucleation without difficulty. The capsule was attached to the periosteum of the lower femur. On removal tumor weighed a little less than 15 lbs., it was filled with a yellowish oily fluid and numerous small oil cysts.

A boy, of 14, whose case is narrated by K. C. Jaidka[2] had an *ossifying sarcoma* of vastus externus, necessitating hip-joint disarticulation. There was little bleeding, and patient stood the operation well. Three days after operation injections of Coley's fluid were commenced and continued for 6 weeks; the patient then left in good condition and with wound practically healed. The tumor was situated in the muscle, and appeared to be limited to it, there being a definite layer of degenerated muscle fibres over it. The deep surface was smooth and somewhat flattened. On sawing through the tumor longitudinally it was seen to be composed of cancellous bony substance, with a fairly definite outline except at its poles, where it was softer, and seemed to merge into the surrounding muscle. The fibres in these regions were swollen and had a hyaline appearance. In the tumor were numerous cavities of irregular

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(1) Southern Med. Jour., February, 1919.
(2) British Med. Jour., Sept. 20, 1919.

shapes and varying size, the largest in centre. They contained thick, altered blood.

Patella. A very practical *splint for fracture* is described by J. J. Rectenwald,[3] made of thin leather, straps, and felt pad. In the illustration parts *1* and *2* have a semilunar inlay of sole leather to make them more rigid in their grasp about the patella, *1* thigh piece, *2* leg pad; part *3* is the patella pad, which keeps the fragments from springing forward; *4, 4, 4, 4* the straps to hold *1* and *2* tight to skin to prevent slipping; *5, 5,* are straps to pull fragments in close apposition; *6* is felt pad to prevent straps from irritating skin.

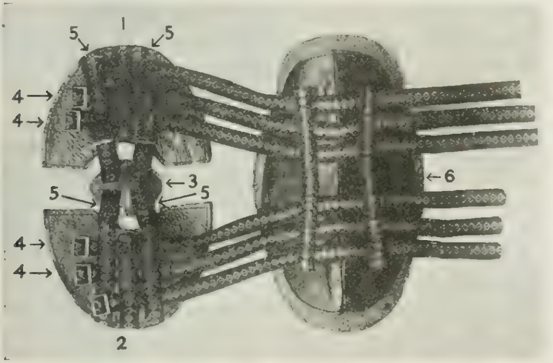

Fig. 173. Splint for patella (Rectenwald).

The splint should be applied early but not so tightly as to retard the circulation.

Apply a mixture of tallow, 1 dram, burgundy pitch, 3 oz. "melted," to under surface of parts *1* and *2*, within 1 in. of the outer border. Apply the pads, one close to the upper, the other close to the lower fragments of the patella and wait until the pitch has become thoroughly adherent to the skin. Apply the posterior pad of felt or rigid splint, whichever one prefers. Tighten straps *4* which keeps pads from slipping. When satisfied pads *1* and *2* are well fixed, tighten straps *5* which brings fragments together and presses

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(3) Surg., Gynecol. and Obstet., November, 1919.

patella pad *3* close to the patella and thus prevents the fractured ends from bulging (pressing forward).

The good points about this appliance are that it is quick, easily applied, well adapted to the weak and aged, although just as useful for young. It makes a splendid ambulatory treatment, does not expose to infection of the knee-joint, and brings the fragments in perfect apposition. It is a splendid appliance after an open operation to help complete the good work of the surgeon, and well can be worn for months to prevent secondary fracture. The most important is the pitch which does its part admirably holding fast for weeks. There is no reason why an anteroposterior or lateral plaster-of-paris splint, "Buchanan," cannot be applied over this appliance to make it more serviceable for ambulatory treatments.

Knee. *Open amputation through the knee-joint* was done by M. K. Smith,[4] for suppurative arthritis, and gangrene, each 3 cases. Its advantages over open amputation through the lower thigh are: (1) less opportunity for infection in the stump; (2) improvement in the ultimate stump; (3) lessened operative shock.

1. Danger and loss of time from bone infection in a stump is minimized. It is evident there is much greater risk from infection when the femur is sawn across, especially in the suppurating cases, than in amputating through the joint, which neither opens fresh bone channels nor the marrow cavity. In general, these stumps clean up quite satisfactorily, depending, however, on the amount of destruction of the cartilage, and the presence of osteitis in the condyles.

2. All the open knee-joint amputations require reamputation. As, however, many of the open thigh amputations require the same thing, with the alternative of an adherent terminal scar, it is not an objection. On the other hand, amputation through the knee conserves the maximum amount of material for a long serviceable stump when the time for reamputation comes. There is a further advantage with regard to obtaining the most useful stump, namely, that in a certain proportion of

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(4) Annals of Surg., September, 1919.

such amputations through the knee, the reamputation may be in the form of osteoplastic a Gritti.

The technic varies according to the local condition. As long flaps, especially anterior ones, should be made as is feasible. The patella should be spared at the primary operation, whenever possible, to preserve the possibility of doing a later osteoplastic reamputation.

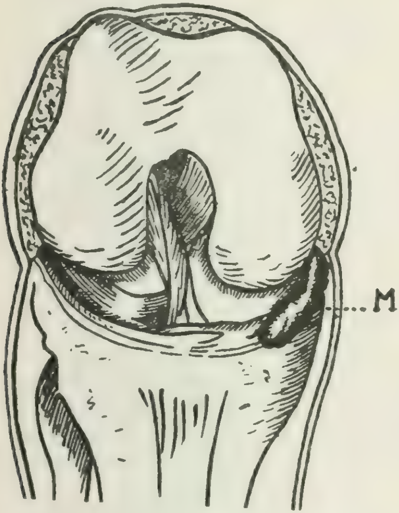

Fig. 174. Knee joint opened to show the internal cartilage (*M*) partly dislocated and enlarged (Brau-Tapie).

Dislocation of the int. semilunar cartilage occurred in a woman under the care of J. Brau-Tapie.[5] About 6 months previous, she made a misstep and felt something "crack" in knee. While complete flexion could be carried out, extension was impossible. This recurred 15 times. When seen, the condition had been permanent over a month. The lesion was correctly diagnosed and confirmed by operation, when the swollen cartilage was removed, primary healing. A month later could stand and walk perfectly. Excision was chosen in preference to meniscopexy on account of the marked swelling.

A report on 82 *war wounds of knee* is made by McWilliams and Hetzel.[6] In 32 patients there was *no fracture* present. In 8 there were all combinations of comminuted fractures, patellæ being fractured in 18, femora in 29, tibiæ in 12 and fibula in 1.

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(5) Jour. de Méd. de Bordeaux, Aug. 10, 1919.
(6) Annals of Surg., September, 1919.

Of 73 cases operated upon in Evacuation Hospital 1, for knee-joint injuries, 57 *remained clean,* or 78 per cent., an excellent showing. Twenty-one surgeons reported on these cases, so the results speak well for the careful technic so far as asepsis is concerned. In 70 of 76 known cases the synovial membrane was completely closed while 6 were drained into joint. They have information as to the final results, so far as motions are concerned, in 36 of the clean cases. Of these 36 patients, 9 had perfect function at discharge, ankylosis in 3. In 24 there was some motion in varying degrees.

They have accurate reports in 73 cases as to infection, obtained on completion of the case. Of these cases, 16 became subsequently infected. It appears the average duration was 10.8 hours excluding the 81-hour case. Many of these patients had complicated comminuted fractures, but it is noteworthy that 5 of these septic cases had no fracture of the joint. To sum these results up, we find 4 with ankylosis, 1 with resection, 3 with amputations, 4 died as the immediate result of the subsequent infection, 1 with flexion to 90° two months after operation, 3 no report of functions obtainable.

Of the entire 82 patients, 9 died. The time before operations and the cause follow:

	Time between injury and operation
Streptococcus septicæmia	9½ hours
Pyæmia	23 hours
Numerous wounds	13 hours
Secondary hemorrhage from thigh wound, 15 days after operation	5 hours
Gas gangrene of thigh	20 hours
Numerous wounds. Shock	6 hours
Pyæmia	Duration not given
Septicæmia	Duration not given
Shock	6 hours

They conclude no joint injury should be evacuated within 10 days after operation. The joint should be completely closed at operation. No splint should be used except where fragments will be displaced. The Willems after-treatment of immediate, continuous, active motions should be unceasingly kept up day and night both in the aseptic and septic cases.

In each hospital there should be a day and a night nurse who should be conversant with the method and whose only function it should be to carry out the active motions.

Located in a mining district (Idaho), M. T. Smith[7] has had to deal with many *injuries to knee,* and tells of his experience for 5 years:

Sprains of the lateral ligaments were seen in 71 cases and 59 of these were of int. ligament.

Treatment consists of rest in bed with splinting until the effusion in the joint is partially absorbed, followed by pressure bandaging about the joint and gradual weight bearing, with slight elevation of the sole of shoe on affected side.

Injury to the semilunar cartilages, resulting in dislocation or fracture, was second in frequency. The etiology in 17 cases treated was a sudden twist with leg in flexion and foot rotated out. The int. cartilage was injured in all and this is readily explained on account of its intimate association with the int. lateral ligament, the inner fibers of which are attached to the anterior horn of the int. cartilage.

Treatment of initial injury consists of complete flexion on thigh, with internal rotation of foot and quick extension, or some modification of this plan. Usually cartilage is released and leg can be completely extended. Patient should then rest in bed 2 to 3 weeks, followed by gradual weightbearing with pressure support about knee to prevent effusion. Healing of cartilage usually occurs, but some subsequent trivial injury may cause a recurrence of the locking, accompanied by pain and effusion, and this may occur repeatedly, constituting a disability so marked the patient finally submits to operation.

Seven loose bodies were caused by direct injury to a normal knee, resulting in the knocking off of a piece of the articular surface. Removal can usually be accomplished under a local anesthesia, after the loose body has been located and impaled on a needle.

Gentian violet irrigations were used in septic arthritis

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(7) Northwest Med., December, 1919.

by J. W. Churchman.[8] The cause was *S. aureus,* and complicated a c.c. fracture of the patella. As the boy was admitted 20 days after his injury, at which time a purulent arthritis was well developed, and as there was in addition to the fracture a large gash below the knee-cap, which on admission had developed into an infected granulating wound, the test of this treatment could hardly have been more severe. The result, however, was a complete cure of the septic arthritis; and they were subsequently able to suture the fractured patella—which healed by first intention as though no infection had previously been present—and finally to give the patient a normal leg.

Concerning *joint infections,* H. K. Wallace[9] states from the standpoint of treatment they can be divided into 3 classes: (*A*) Wounds operated on within first 24 to 48 hours, with potential infection, but no time for pus formation; (*B*) Infection for 48 to 72 hours, with swelling, redness and exudation, and beginning of pus formation; (*C*) Duration from several days to weeks, purulent arthritis well established with more or less erosion and absorption of joint surfaces.

Joints potentially infected, but operated early, may be closed after removal of all foreign bodies, devitalized, and dead tissue. Soft parts closed primary or secondary. Joints infected, but operated early, should be opened, all foreign bodies removed, but no drains inserted *into joints,* being kept open by gauze fluffs down to the joint, and active motion begun the day after operation. Septic joints of a week's or more duration, and with more or less erosion of the articular surfaces, should be opened widely just below the patella on each side, the incision extending the whole length of the suprapatellar pouch with a posterior incision. Passive motion and later active motion begun at the time of each dressing. Dakin's solution-packs for dressing.

There are three points to emphasize in these cases: In the first class, with *débridement* without regard to anatomic structure. In the second, the ample incisions with *no* drainage material into the joint cavity, and

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(8) Jour. Amer. Med. Ass'n., May 3, 1919.
(9) Railway Surg. Jour., November, 1919.

early and continued active motion. And, in the third, extensive incisions with always a posterior incision.

Since resuming civil practice, Wallace had 3 knee injuries. One of the first class, and two of the second: (I) a piece of steel entered the joint and lay just below patellar lig. He was operated 36 hours after injury, *débridement* of soft parts and injured synovia and the steel removed. The cavity filled with ether and wound closed. There was no pain or swelling following, and patient went home one week later with a perfect result. (II) infected prepatellar bursa following a kick by a mule, which had ulcerated through into joint. This was incised through the prepatellar pouch and necrotic tissue of the patellar lig. excised, draining joint through ant. incision and Dakin dressings used. Patient went home in 3 weeks with a freely movable joint, which had closed by this time, and the superficial wound was healing by granulations. (III) still in hospital. He came in 5 days after injury with a draw-knife, which had entered the joint. When first seen there was a large purulent effusion in the joint. Patient was septic and periarticular tissues greatly swollen. This was treated as described for the second class of cases. In about 3 weeks, joint closed except one small opening on each side, from which clear fluid is expelled on motion. The wounds in the soft parts will heal by granulations. He has motion up to r. angle flexion with no pain, and walks with crutches.

The value of the above-outlined treatment has been proven by Wallace's experience with some 150 infected knees, in Base Hospital 69, Savenay (France). Of the first class he saw only the end-results, which were almost uniformly good. The second and third class, he had in abundance, and after trying numerous incisions, etc., found the one described far the most satisfactory.

At a meeting of the Philadelphia Academy of Surgery, J. B. Roberts[1] presented a man with *Charcot knee-joints* who had been under treatment for lues prior to and subsequent to coming under Roberts' care for *syphilitic fracture of b. b. of r. leg* just above ankle. There seemed to be nothing special in the *x*-ray ap-

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(1) Annals of Surg., February, 1919.

pearances to suggest a bone dyscrasia. Union took place and the man was discharged with what appeared to be a well-united fracture. It was the opinion of Roberts at that time that the fracture was not due to syphilitic softening and the man was expected to have no further difficulty if he postponed weight bearing for the usual period. A number of months afterward he came under observation again and said he had been walking without any special support. The leg showed a large mass of bone and callus with lateral and backward displacement at the fracture. The appearances still exist but he has been wearing now a brace to prevent further disability. The Charcot knees are characteristic and the man has been under constant treatment about 4 years, taking large amounts of KI and Hg and many injections of salvarsan. The long-continued treatment with the support given has brought this man to a condition which enables him to make a living.

Popliteal Space. Matas' operation was performed for *popliteal aneurism* by G. P. Tyler, Jr.[2] The patient was a negro, aged 32; Feb. 18, almost a quart of clots was removed, the opening was about 1.2 in. long. Since closing the rupture would not encroach upon lumen, this was decided upon. Over a rubber tube coated with sterile liquid petroleum, interrupted sutures of fine silk saturated in petroleum were placed. The tube was then withdrawn and sutures tied. Additional ones were placed wherever it seemed blood might escape. This row was reinforced by a second one. The wall of sac had several large sclerotic patches. To close the openings of all the anastomosing branches would have required dissection much greater than already done; hence

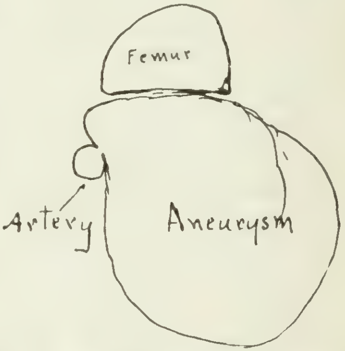

Fig. 175. Location of popliteal aneurism (Tyler).

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(2) New Orleans Med. and Surg. Jour., December, 1918.

the wall was reefed with interrupted Pagenstecher sutures until a compact mass resulted. The muscle and skin were then closed. At this stage the tourniquet was released. A pulsation appeared, and blood oozed between the skin edges. The tourniquet was immediately tightened. Three silkworm-gut sutures were taken into deep tissues and tied over small rolls of gauze. A snug bandage was applied over the dressing, when the tourniquet was again released, but not removed until all danger of sudden hemorrhage had passed—3 days. Recovery was uneventful. There was a discharge of broken-down blood from wound several days after operation. A part of the sac also came away.

The foot remained warm, but pulsation of d. pedis was not restored. He developed a foot-drop—caused, most probably, by injury to ext. popliteal nerve. For 2 months also he could not flex the leg on thigh. When discharged on April 15, he was walking with crutches; could bend leg slightly, and some improvement in ability to extend foot. There was no evidence of weakness at the line of suture. In August, could bend leg easily; had regained more power to extend the foot. No pulsation of pedis. He loses no time from his work.

Ankle. An unusual war injury came under the notice of H. C. Orrin,[5] *fracture-dislocation of astragalus* with post. displacement of upper fragment. The soldier aged 46, was rendered unconscious during a bomb raid, but it is thought foot was fixed, and body forced away laterally by explosion. When the bone was fully exposed, its position was still more remarkable, for not only had a fracture-dislocation occurred, but in its displacement back the upper half was found rotated on itself, so its superior articular surface was looking in. No tendons or important structures were divided in the operation, and wound closed without drainage. Healing by first intention. Passive movements and massage were commenced early, and when patient walked out of hospital (10 weeks later) his range of movement was most remarkable.

Foot. As regards *sole plate traction*, W. F. Cunning-

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(5) Lancet, Jan. 4, 1919.

ham[7] observes the field is less than before Nov. 11, 1918, but occasionally in civil life, in crushing injuries of leg or compound fractures with badly lacerated soft parts, the method of traction becomes a puzzle. There are cases when traction strips cannot be used, and cases when Steinmann pins, etc., cannot be used without the risk of opening up new foci for micro-organisms to lodge and thereby increase infection. It was for just such cases that Sinclair devised the "skate." This mechanism was glued to the sole and strips for reinforcement carried over the dorsum. In certain cases the skin of the dorsum is in such condition that strips cannot be applied.

At No. 1 General Hospital, B. E. F., they had many cases of this type, and used an accurately molded sole plate with a 10-per cent. celluloid solution. The plate is made as follows: A light plaster impression of the plantar surface is made of 4 or 5 layers of bandage over Canton flannel long enough to extend from just beyond the big toe to the attachment of Achilles tendon. This is accurately molded by hand and held in position for 30 min. by a snug bandage over cotton. This is removed and reinforced by an aluminum strip, secured to the impression by a plaster bandage to which are attached traction cords. These should be so placed the line of pull will pass through the center of int. malleolus, which position will prevent foot-drop. After the mold has been thoroughly dried in an oven, a quantity of the 10 per cent. celluloid is poured into it and the whole is applied to the foot. A bandage over cotton is necessary to hold it in place until thoroughly dried. One to two hours are allowed for this, and a 12- to 15-pound traction may be used. Several of these with from 9 to 15 pounds of traction have been observed for 30 days and more.

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(7) Jour. Amer. Med. Ass'n., Sept. 27, 1919.

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